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THE UNIVERSITY OF
NEW SOUTH WALES

Faculty of
Engineering

HANDBOOK

1997

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NEW SOUTH WALES

Faculty of
Engineering

HANDBOOK

1997

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Old subject measures have been replaced by new university credit points. Every effort has been made to ensure the accuracy of the credit point values shown for all subjects. However, if any inconsistencies between old and new credit point measures cause concern, students are advised to check with their faculty office for clarification before making 1997 subject selections based on the credit points

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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, Geomatic Engineering, and Mechanical and Manufacturing Engineering. It also has two graduate schools, the Graduate School of Biomedical Engineering and the Graduate School of Engineering and a number of faculty centres. Furthermore, the Faculty is actively involved with seven Cooperative Research Centres (CRCs).

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). There are also a number of combined degree courses available which lead to the award of two degrees, as well as a concurrent degree program leading to the award of a bachelor and masters degree. 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.

M.S. Wainwright
Dean
Faculty of Engineering

Calendar of Dates

The academic year is divided into two sessions, each containing 14 weeks for teaching. Between the two sessions there is a break of approximately six weeks, which includes a one-week study period, two weeks for examinations, and three weeks recess. There is also a short recess of one week within each session.

Session 1 commences on the Monday nearest 1 March.

Faculties other than Medicine, AGSM and University College

	1997	1998
Session 1		
(14 weeks)	3 March to 27 March 7 April to 13 June	2 March to 9 April 20 April to 12 June
Mid-session recess	28 March to 6 April	10 April to 19 April
Study period	14 June to 19 June	13 June to 18 June
Examinations	20 June to 8 July	19 June to 7 July
Mid-year recess	9 July to 27 July	8 July to 26 July
Session 2		
(14 weeks)	28 July to 26 September 7 October to 7 November	27 July to 25 September 6 October to 6 November
Mid-session recess	27 September to 6 October	26 September to 5 October
Study period	8 November to 13 November	7 November to 12 November
Examinations	14 November to 2 December	13 November to 1 December

Important dates for 1997

January 1997

W 1 New Year's Day – Public Holiday
M 13 Medicine IV – Term 1 begins
Th 16 Medicine V – Term 1 begins
M 27 Australia Day – Public Holiday
T 28 Enrolment period begins for new undergraduate students and undergraduate students repeating first year
W 29 AGSM EMBA Executive Year – Session 1 begins

February 1997

M 10 AGSM EMBA GMQ and GDM programs – Session 1 begins
M 24 AGSM MBA program – Year 1 classes – Term 1 begins
Medicine VI – Term 2 begins

March 1997

M 3 Session 1 begins – for Faculties other than Medicine and AGSM
University College, ADFA – Session 1 begins
AGSM MBA program – Year 2 classes – Term 1 begins
F 14 Last day applications are accepted from students to enrol in Session 1 or whole year subjects
Su 16 Medicine IV – Term 1 ends
M 17 Medicine IV – Term 2 begins
Su 23 Medicine V – Term 1 ends
F 28 Good Friday – Public Holiday
Mid-session recess begins – for Faculties other than Medicine, AGSM and University College, ADFA
S 29 Easter Saturday
Su 30 Easter Sunday

M 31 Last day for students to discontinue without failure subjects which extend over Session 1 only.
HECS Census Date for Session 1
Easter Monday – Public Holiday

April 1997

T 1 Medicine V – Term 2 begins
Su 6 Mid-session recess ends – for Faculties other than Medicine, AGSM and University College, ADFA
Su 13 Medicine VI – Term 2 ends
M 14 Medicine VI – Recess begins
Su 20 Medicine VI – Recess ends
M 21 Medicine VI – Term 3 begins
F 25 Anzac Day – Public Holiday
Su 27 Medicine IV – Term 2 ends
M 28 Medicine IV – Recess begins

May 1997

S 3 University College, ADFA – May recess begins
Su 4 Medicine IV – Recess ends
M 5 Medicine IV – Term 3 begins
F 9 AGSM MBA program – all classes – Term 1 ends
M 12 AGSM MBA program – all classes - Examinations begin
T 13 Publication of provisional timetable for June examinations
F 16 AGSM MBA program – all classes – Examinations end
Su 18 University College, ADFA – May recess ends
W 21 Last day for students to advise of examination clashes
S 24 AGSM EMBA GMQ and GDM programs – Session 1 ends
AGSM EMBA GMQ and GDM programs – Examination
T 27 AGSM EMBA Executive Year – Session 1 ends

June 1997

Su 1 Medicine V – Term 2 ends
Medicine VI – Term 3 ends
M 2 AGSM MBA program – all classes – Term 2 begins
Medicine VI – Term 4 begins
T 3 Publication of timetable for June examinations
M 9 Queen's Birthday – Public Holiday
T 10 Medicine V – Term 3 begins
F 13 Session 1 ends – for Faculties other than Medicine, AGSM and University College, ADFA
S 14 Study period begins – for Faculties other than Medicine, AGSM and University College, ADFA
Su 15 Medicine IV – Term 3 ends
M 16 Medicine IV –Term 4 begins
Th 19 Study period ends – for Faculties other than Medicine, AGSM and University College, ADFA
F 20 Examinations begin – for Faculties other than Medicine, AGSM and University College, ADFA
University College, ADFA – Session 1 ends
M 23 University College, ADFA – Examinations begin
AGSM EMBA Executive Year - Session 2 begins

July 1997

S 5 University College, ADFA – Examinations end
Su 6 University College, ADFA – Mid-year recess begins
T 8 Examinations end – for Faculties other than Medicine, AGSM and University College, ADFA
W 9 Mid-year recess begins – for Faculties other than Medicine, AGSM and University College, ADFA
M 14 AGSM EMBA GMQ and GDM programs – Session 2 begins
Su 20 University College, ADFA – Mid-year recess ends
M 21 University College, ADFA – Session 2 begins
F 25 Medicine VI – Term 4 ends
S 26 Medicine VI – Recess begins
Su 27 Mid-year recess ends – for Faculties other than Medicine, AGSM and University College, ADFA
M 28 Session 2 begins – for Faculties other than Medicine, AGSM and University College, ADFA

August 1997

Su 3 Medicine VI – Recess ends
M 4 Medicine VI – Term 5 begins
F 8 Last day applications are accepted from students to enrol in Session 2 subjects
Last day for students to discontinue without failure subjects which extend over the whole academic year
AGSM MBA program – all classes – Term 2 ends
Su 10 Medicine IV – Term 4 ends
Medicine V – Term 3 ends
M 11 AGSM MBA program – all classes – Examinations begin
Medicine IV – Recess begins
F 15 AGSM MBA program – all classes – Examinations end
Su 17 Medicine IV – Recess ends
M 18 Medicine IV – Term 5 begins
Medicine V – Term 4 begins
Su 31 Last day for students to discontinue without failure subjects which extend over Session 2 only
HECS Census Date for Session 2

September 1997

M 1 AGSM MBA program – all classes – Term 3 begins
S 6 Open Day
Su 14 Medicine VI – Term 5 ends
M 15 Medicine VI – Term 6 begins
F 26 Closing date for applications to the Universities Admission Centre
S 27 Mid-session recess begins – for Faculties other than Medicine and AGSM University College, ADFA – Septembe
recess begins
Su 28 Medicine IV – Term 5 ends
M 29 Medicine IV – Term 6 begins

October 1997

M 6 Labour Day – Public Holiday
Mid-session recess ends – for Faculties other than Medicine and AGSM
University College, ADFA – September recess ends
T 7 Publication of provisional timetable for the November examinations
W 15 Last day for students to advise of examination clashes
F 17 AGSM EMBA Executive Year - Session 2 ends
Su 19 Medicine V – Term 4 ends
F 24 University College, ADFA – Session 2 ends
Su 26 Medicine VI – Term 6 ends
M 27 University College, ADFA – Examinations begin
T 28 Publication of timetable for November examinations

November 1997

S 1 AGSM EMBA GDM program – Session 2 ends
AGSM EMBA GDM program – Examination
F 7 Session 2 ends – for Faculties other than Medicine, AGSM and University College, ADFA
AGSM MBA program – all classes – Term 3 ends
S 8 Study period begins – for Faculties other than Medicine, AGSM and University College, ADFA
AGSM EMBA GMQ program – Session 2 ends
AGSM EMBA GMQ program – Examination
Su 9 Medicine IV – Term 6 ends
M 10 AGSM MBA program – all classes – Examinations begin
Th 13 Study period ends – for Faculties other than Medicine , AGSM and University College
F 14 Examinations begin – for Faculties other than Medicine , AGSM and University College
AGSM MBA program – all classes – Examinations end
University College, ADFA – Examinations end

December 1997

T 2 Examinations end – for Faculties other than Medicine, AGSM and University College, ADFA
Th 25 Christmas Day – Public Holiday
F 26 Boxing Day – Public Holiday

Staff

Comprises Schools of Civil Engineering, Computer Science and Engineering, Electrical Engineering, Mechanical and Manufacturing Engineering (incorporating Aerospace Engineering and Naval Architecture), Geomatic Engineering, the Graduate School of Biomedical Engineering, the Graduate School of Engineering and Centres for 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.

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Kevin Elphinstone, BE BSc *UNSW*
Stephen Fischer, BSc *Rice*
Simran Gambhir BSc UNSW Nick Maddern, BSc *Kent*
Rob Moser, BSc *Calif.*
Geoffrey Morris Oakley, BSc *UNSW*
Alexei Parchkov, BE *Al Moscow*
Zain Rahmat, BSc *UNSW*
Carlos Reyes, BSc *CU Venezuela*, MSc *Houston*
Jerry Vochteloo, BSc *UNSW*
Aidan Williams, BSc BE *UNSW* Yoko Suk Har Wong BSc Saskatchewan

Professional Officers
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Serge Poplavsky, Dipl Ing *Bratislava*, ME *UNSW*
Keith William Titmus, BScTech MEngSc *UNSW*

Engineers
Ricky Chan, BSc PhD *UNSW*
Herbert Chen, BSc *UNSW*
Ming Chi Joseph Kam, BSc *UNSW*
Leung Him Li, BE *UNSW*

School of Electrical Engineering

Professor of Electrical Engineering and Head of School
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Professors of Electrical Engineering
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Martin Andrew Green, BE MEngSc *Qld.*, PhD *McM.*, CPEng, FAA, FTS, FIEEE, FIEAust
I. F. Morrison
Neville Waller Rees, BSc PhD *Wales*, CPEng, FIEAust, SMIEEE

Executive Assistant to Head of School
Dr T. Hesketh

Executive Officer
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Administrative Assistant
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Associate Lecturer
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Professional Officer
Peiyan Chen, BE XIBEI *Telecom.Eng.Univ.,China*

Department of Communications

Associate Professor and Head of Department
The Bao Vu, BE PhD *Adel.*, CPEng, FIEAust, SMIEEE

Associate Professor
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Senior Lecturers
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Edward Henry Fooks, BSc PhD *Lond.*, CEng, FIEE, MIEEE
Christopher John Elliott Phillips, BSc BE PhD *Syd.*, MIEEE
Robert Radzyner, BE *Melb.*, MEngSc PhD *UNSW*, SMIEEE, SMIREE
Ramutis Anthony Zakarevicius, BSc BE MEngSc PhD *Syd.*, CPEng, MIEAust, SMIREE, SMIEEE

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Rodica Ramer, BSc ME PhD *Bucharest*, MIEEE, MAPS
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Thomas Millett, BAppSc *N.S.W.I.T.*

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Department of Electric Power Engineering

Associate Professor and Head of Department
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Fazlur Muhammed Rahman, BScEng *BUET(Ban)*, MSc PhD *Manc.Inst.Sci.&Tech.*, MIEEE, AMIEE, MISA
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Department of Electronics

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Senior Lecturers
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Timothy Hesketh, MScEng *CapeT.*, PhD *Massey*, MIEEE

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Photovoltaics Special Research Centre

Director
Professor M. A. Green

Associate Directors
Associate Professor P. A. Basore
Associate Professor H. R. Outhred
Associate Professor S. R. Wenham

School of Geomatic Engineering

Professor and Head of School
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Professor
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Associate Professors
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Christopher Rizos, BSurv PhD *UNSW*
Jean Marc Rueger, Diplng E.T.H. Zurich, PhD *UNSW*, ACSM, LSSwitz, MISAust
Artur Stolz, BSurv PhD *UNSW*

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Ewan Gerald Masters, BSurv PhD *UNSW*, MISAust

Lecturers
Sabapathy Ganeshan, BSc *Ceyl.*
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Professional Officers
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Stephen Kenneth Johnson, BSurv *UNSW*
Philip Hong Lam

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

School of Mechanical and Manufacturing Engineering

Incorporates Aerospace Engineering and Naval Architecture

Nuffield Professor of Mechanical Engineering and Head of School
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Professor and Director of Laboratories
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Associate Professor and Director of Undergraduate Studies
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Associate Professor and Undergraduate Admissions, Advanced Standing Officer
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Associate Professsor and Director of Graduate Studies
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Alexander Eric Churches, BE PhD *UNSW*, ASTC, FIEAust, CPEng, FRSA
Henry Ehikpehale Enahoro, BSc MScTech *Manc.*, PhD *Sheff.*, CPEng, FIMechE, MIProdE
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Emeritus Professor
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Honorary Visiting Fellows
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Administrative Assistant (School Offfice)
Guilia Pearson

Professional Officers
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Department of Aerospace Engineering

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C. Patterson

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R. A. J. Ford
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Khosrow Zarrabi, MSc PhD *UMIST*, MIEAust

Department of Design

Associate Professor and Head of Department
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Department of Fluid and Thermal Engineering

Associate Professor and Head of Department
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G. L. Morrison

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Lecturer
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Department of Industrial Technology and Management

Sir James Kirby Professor of Manufacturing Engineering and Head of Department
Hartmut Kaebernick, Dipl-Ing Dr-Ing *T.U. Berlin*, CPEng, FIEAust, SMSME, VDI

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Khoi Hoang, BE *Saigon*, PhD *UNSW*
Atiye Berman Kayis, BSc MS *M.E.T.U.*, PhD *Istanbul T.U.*
Philip Mathew, BE PhD *UNSW*, CPEng, MIEAust

Lecturer
Ka Ching Chan, MASc *Tor.*, PhD *UNSW*, CPEng, MIEAust

Associate Lecturer
Maruf Hasan, BScEng *B'desh Engin.*, MEng *Asian I.T.*, CPEng, MIEAust

Department of Mechatronics

Senior Lecturer and Head of Department
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Michal John Tordon, Diplng *Bratislavaa*, PhD *Prague*, MIEEE

Department of Naval Architecture

Associate Professor and Head of Department
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Centre for Manufacturing and Automation

Director
Dr S. S. Leong

Graduate School of Biomedical Engineering

Professor and Head of School
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Nigel Hamilton Lovell, BE PhD *UNSW*, MIEAust, MIEEE

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Laura Anne Poole-Warren, BSc PhD *UNSW*

Professional Officer
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Administrative Assistant
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Graduate School of Engineering

Professor and Head of School
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Senior Administrative Officer
George John Harris, BA *UNSW*

MBT Program
Director (Management)
Dr A. J. Robinson

MBT Program
Director (Corporate)
Warren Stevens, ACA

Administrative Assistants
Margaret Elizabeth Brennan
Narelle Dickson

Centre for Advanced Numerical Computation in Engineering and Science

(in association with the Faculty of Science)

Professor and Director
Clive Allen John Fletcher, BScEng *Lond.*, MSc *Cran.I.T.*, PhD *Univ.Calif.(Berkeley)*, CPEng, MRAes, MAIAA

Lecturer
Yaping Shao, DipMet *Bonn*, PhD *Flin.*
Shenglin Di, BScEng *Hefei*, ME *Nanjing I.T.*, PhD *S.E.Nanjing*

Administrative Assistant
Lili Shuartono
Li Lin

Centre for Remote Sensing and Geographic Information Systems

(in association with the Faculty of Applied Science)

Director
Professor B. C. Forster

UNSW Groundwater Centre

(in association with the Faculty of Applied Science)

Director
Jerzy Jankowski, MSc PhD *Wroc.*

Senior Lecturer
Dr R. I. Acworth

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 **Summary of Courses (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 point 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 (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 Engineeering (ELEC), Computer Science and Engineering (COMP), Civil Engineering (CIVL) or Geomatic Engineering (GMAT) 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 Summary of Courses.** 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 Summary of Courses**. 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.

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:

CP	credit points
F	full year (Session 1 plus Session 2)
HPW	hours per week
L	lecture
P/T	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	weeks of duration
X	external
X1	summer session

Prefixes

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

Prefix	Organisational 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 Advanced Numerical Computation in Engineerig and Science	Engineering/Science
BIOM	Graduate School of 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
GMAT	School of Geomatic Engineering	Engineering
GSOE	Graduate School of Engineering	Engineering
INDC	Department of Industrial Chemistry	Applied Science
IROB	School of Industrial Relations & Organisational Behaviour	Commerce & Economics
LAWS	School of Law	Law
LIBS	School of Information, Library & Archive Studies	Professional Studies
MANF	School of Mechanical & Manufacturing Engineering	Engineering

Prefix	Organisational Unit	Faculty/Board
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 and 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 representative listed below:

School of Civil Engineering: Ms K. Irvine, Room 406, Civil Engineering Building.

School of Computer Science and Engineering: Dr G.R. Whale or Mr C. Flatters, School Office, Room 313, Electrical Engineering Building.

School of Electrical Engineering: Dr T. Hesketh,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 Geomatic Engineering: Mr L. Daras, School Office, Room 529, Geography and Geomatic Engineering Building.

Graduate School of Biomedical Engineering: Professor K. Schindhelm, 5th Floor, Samuels Building.

Graduate School of Engineering: Mr G. Harris, Room 447,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)
2u and 3u (100-150)
3u and 4u (100-200)

Additional subject prerequisites

Mathematics
2u (90-100)

and

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)

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 required prerequisite/s in Mathematics, Chemistry or Physics. Remedial English is also available for students who do not have the required prerequisite in English. 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 1997 or enrolling in graduate courses should obtain a copy of the free leaflet Re-Enrolling 1997 available from School offices and the Student Centre. 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 admission to the degree.

Computing at UNSW

The Division of Information Services (DIS) encompasses information technology and the University Library at UNSW.

Specific University information which is frequently updated is available on the World Wide Web (WWW) in the UNSW home page at **http://www.unsw.edu.au** which has an index to its contents which includes URLs **http://www.acsu.unsw.edu.au** and **http://www.misu.unsw.edu.au**. You can access this information from your workstation and in any computing laboratory with access to WWW through Mosaic or Netscape.

The information provided on the WWW includes more details about DIS information technology units such as points of contact for particular areas of responsibility and services provided.

Faculty of Engineering Library Facilities

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

The Physical Sciences Library

The Physical Sciences Library, located on levels 5, 6 and 7 of the Library Building, provides information for students and staff from the Faculties of Science, Engineering, the Built Environment and Applied Science.

During the academic year the Library is open from 8.00 am to 10.00 pm Monday to Thursday, 8.00 am to 6.00 pm on Friday and 12.00 pm to 5.00 pm Saturday and Sunday. During vacations, these hours will vary.

Staff assisted services are available after 10.00 am including help with catalogue, CD Roms, inter-library loans, maps and online searching. An information skills program is in place with emphasis on developing basic information access and management skills for first years and advanced skills for final year and postgraduate students.

The Library's catalogue and selected CD-Rom databases are available over the Campus Wide Network.

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); Geomatic Engineering Society (GMATSOC formerly 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; specialised 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 Adviser to students with Disabilities, 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 9385 5418 or at Student Services, Quadrangle Building.

Student Equity

The University of New South Wales is committed to providing an educational environment that is free from discrimination and harassment. Both commonwealth and state anti-discrimination law requires the University not to discriminate against students or prospective students on the following grounds: sex, race/ethnicity, age, disability, sexual harassment, racial harassment, disability harassment, marital status, pregnancy, sexual preference, HIV/AIDS. Also included are acts of vilification on the grounds of: race and HIV/AIDS.

Complaint/Disputes
The University has internal dispute handling procedures to deal with complaints against staff or other students. The Discrimination and Harassment Grievance Procedures are handled by the Student Equity Unit of the Equal Employment Opportunity Unit. Complaints that largely concern academic matters are usually handled through the Head of School.

Advocacy and Support
Students can seek assistance getting disputes resolved, either in relation to discrimination or academic matters. Assistance can be sought from various areas in the University including:

Student Equity Unit; Student Guild Advocacy Service; Student Counselling; Equal Employment Opportunity Unit; Course Co-ordinators; Senior Academic Staff; Heads of School.

Students may be confident that their interests will be protected by the University if a complaint is lodged. This means that students should not be disadvantaged or victimised because they have, in good faith, sought to assert their rights to equal opportunity in education.

Equal Opportunity in Education Policy Statement

Under the Federal Racial Discrimination Act (1975), Sex Discrimination Act (1984), Disability Discrimination Act (1992) and the New South Wales Anti-Discrimination Act (1977), the University is required not to discriminate against students or prospective students on the grounds of sex, marital status, pregnancy, race, nationality, national or ethnic origin, colour, homosexuality or disability. Under the University of New South Wales Act (1989), the University declares that it will not discriminate on the grounds of religious or political affiliations, views or beliefs.

University Commitment to Equal Opportunity in Education
As well as recognising its statutory obligations as listed, the University will eliminate discrimination on any other grounds which it deems to constitute disadvantage. The University is committed to providing a place to study free from harassment and discrimination, and one in which every student is encouraged to work towards her/his maximum potential. The University further commits itself to course design, curriculum content, classroom environment, assessment procedures and other aspects of campus life which will provide equality of educational opportunity to all students.

Special Admissions Schemes
The University will encourage the enrolment of students who belong to disadvantaged groups through programs such as the University Preparation Program and the ACCESS Scheme. Where members of disadvantaged groups are particularly under-represented in certain disciplines, the responsible faculties will actively encourage their enrolment.

Support of Disadvantaged Students
The University will provide support to assist the successful completion of studies by disadvantaged group members through such means as the Aboriginal Education Program, the Supportive English Program and the Learning Centre. It will work towards the provision of other resources, such as access for students with impaired mobility, assistance to students with other disabilities, the provision of a parents' room on the upper campus, and increased assistance with English language and communication.

Course Content, Curriculum Design, Teaching and Assessment, and Printed Material
Schools and faculties will monitor course content (including titles), teaching methods, assessment procedures, written material (including study guides and handbook and Calendar entries) and audiovisual material to ensure that they are not discriminatory or offensive and that they encourage and facilitate full participation in education by disadvantaged people.

Equal Opportunity Adviser Scheme
The University will continue its Equal Opportunity Adviser Scheme for students who feel that they have been harassed or who consider they have been disadvantaged in their education by practices and procedures within the University.

Harassment Policy
The University is committed to ensuring freedom from harassment for all people working or studying within the institution. It will continue to take action, including disciplinary action, to ensure that freedom from harassment is achieved.

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

IAESTE is an organisation to facilitate overseas work in technical areas in 53 different countries throughout the world for students or recent graduates. It organises 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.

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, Milsons Point 2061.

2. The Institution of Surveyors, Australia

During their years as undergraduates, students in the Geomatic Engineering course are encouraged to take the first steps in joining in the activities of the professional body which represents them - The Institution of Surveyors, Australia. The aims of the Institution are to promote scientific, technical and educational aspects of geomatic engineering 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 Geomatic Engineering and from the Institution Office, Third Floor, Guild House, 363 Pitt Street, Sydney 2000.

The Association of Professional Engineers, Scientists and Managers, Australia

APESMA is a professional organisation that represents the industrial interests of its members with a major focus on providing advice and assistance on employment related matters, including individual representation and improving salaries and conditions for professional engineers, scientists and managers.

Students are invited to become affiliate members (free of charge) of the Association while they are studying. This membership gives students access to information and advice on industrial experience, salary rates for graduates and contracts of employment. Student members receive The Student Update, a publication designed specifically for students, three times a year. This gives students some practical insight into aspect of the workplace to which they may not have given much thought, in particular the employment issues that affect them as professional engineers. More information and student membership application forms can be obtained from APESA, Level 1, 491 Kent Street, Sydney 2000, Telephone 264 9500.

General Information

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

Undergraduate Study
Summary of Courses

The Faculty of Engineering offers the following undergraduate courses:

Bachelor of Engineering
BE

in:
Aerospace Engineering **3610**
Civil Engineering **3620**
Computer Engineering **3645**
Electrical Engineering **3640**
Environmental Engineering **3625**
Geomatic Engineering **3741**
Manufacturing Management **3663**
Mechanical Engineering **3680**
Mechatronic Engineering **3685**
Naval Architecture **3700**
Software Engineering **3648**

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.

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 **3725**
Manufacturing Management **3664**
Mechanical Engineering **3681**
Mechatronic Engineering **3685**
Naval Architecture **3701**

Bachelor of Engineering Bachelor of Arts
BE BA

(5 years duration) in:
Aerospace Engineering **3612**
Computer Engineering **3722**
Electrical Engineering **3720**
Manufacturing Management **3665**
Mechanical Engineering **3682**
Mechatronic Engineering **3687**
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 Engineering in Geomatic Engineering Bachelor of Science in Computer Science
BE BSc

(5 years duration) in:
Geomatic Engineering **3746**

Concurrent Degree Courses

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

Bachelor of Engineering Master of Biomedical Engineering
BE MBiomedE

(5 years duration) in:
Computer Science and Engineering **3728**
Electrical Engineering **3727**
Mechanical Engineering **3683**

Engineering Courses in the Faculty of Applied Science

The University of New South Wales is unique in that there are two faculties offering undergraduate engineering degrees. In addition to the courses offered by the Faculty of Engineering, the Faculty of Applied Science offers the following undergraduate engineering degrees:

Bachelor of Engineering
BE

Bioprocess Engineering **3055**
Ceramic Engineering **3025**
Chemical Engineering **3040**
Fuel and Energy Engineering **3040**
Minerals Engineering **3040**
Mining Engineering **3140**
Petroleum Engineering **3045**

Bachelor of Metallurgical Engineering
BMetE

Metallurgical Engineering **3125**

Bachelor of Materials Engineering
BMatE

Materials Engineering **3615**

There is also an engineering major available in Textile Technology as Textile Engineering.

Subject Areas

The three major subject areas in engineering 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, Mechatronics 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) 9385 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 offers 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 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.)

BE in Aerospace
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 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

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. 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

All students must complete at least 60 working days of approved industrial experience (or professional practice in the case of Geomatic Engineering students) 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. Geomatic Engineering students enrol in a professional practice subject. Schools' entries under Course Outlines and Subject Descriptions should be consulted for details of subject requirements.

Computing Requirements

A number of courses in the Faculty of Engineering have certain computing requirements. To obtain details of these, each student should contact the appropriate School Office in the first weeks of first session.

Access to Exam Information

Students in the Faculty of Engineering may request access to their own final examination scripts and may request consultation with the examiner on their performance provided that a written application is made to the Course Authority no later than fifteen working days after the date of issue of the Notification of Result of Assessment form.

General Education Program

UNSW requires that all undergraduate students undertake a structured program in general education as an integral part of studies for their degree. The University believes that a General Education complements the more specialised learning undertaken in a student's chosen field of study and contributes to the flexibility which graduates are increasingly required to demonstrate. Employers repeatedly point to the complex nature of the modern work environment and advise that they highly value graduates with the skills provided by a broad general education, as well as the specialised knowledge provided in more narrowly defined degree programs. As well, over many years graduates of this University have reported that they greatly valued their General Education studies, which are found to be relevant to both career and personal development.

The General Education Program at UNSW intends to broaden students' understanding of the environment in which they live and work and to enhance their skills of critical analysis.

Objectives of the General Education Program

The following objectives were approved by the Council of the University in December 1994.

1. To provide a learning environment in which students acquire, develop, and deploy skills of rational thought and critical analysis.

2. To enable students to evaluate arguments and information.

3. To empower students to systematically challenge received traditions of knowledge, beliefs and values.

4. To enable students to acquire skills and competencies, including written and spoken communication skills.

5. To ensure that students examine the purposes and consequences of their education and experience at University, and to foster acceptance of professional and ethical action and the social responsibility of graduates.

6. To foster among students the competence and the confidence to contribute creatively and responsibly to the development of their society.

7. To provide structured opportunities for students from disparate disciplines to co-operatively interact within a learning situation.

8. To provide opportunities for students to explore discipline and paradigm bases other than those of their professional or major disciplinary specialisation through non-specialist subjects offered in those other areas.

9. To provide an environment in which students are able to experience the benefits of moving beyond the knowledge boundaries of a single discipline and explore cross- and interdisciplinary connections.

10. To provide a learning environment and teaching methodology in which students can bring the approaches of a number of disciplines to bear on a complex problem or issue.

General Education Requirements

The basic General Education requirements are the same for students in all single degree courses. Over the course of a degree program students:

- satisfactorily complete a minimum of 30 credit points of study in General Education subjects or their equivalent;
- undertake an additional fifty-six (56) hours of study which ensures that students examine the purposes and consequences of their education and experience at university, and fosters acceptance of professional and ethical action and social responsibility. This fifty-six hours of study may be distributed throughout the course, or exist as a separate subject, depending on the course.

Because the objectives of General Education require students to explore discipline and paradigm bases other than those of their professional or major disciplinary specialisation, **all students are excluded from counting subjects toward the fulfilment of the General Education requirement, which are similar in content or approach to subjects required in their course.**

Faculty Requirements

Each Faculty has responsibility for deciding what subjects are *not* able to be counted towards the General Education requirement for their students. The Faculty of Engineering is committed to providing the widest range of choice of general education electives for its students. It strongly encourages students to make the best use of this flexibility. In general, the only restrictions, apart from the usual need for prerequisite knowledge, on the choice of subjects is that, in all but exceptional circumstances, students may not take subjects offered by the Faculty of Engineering, or by schools which offer other subjects already in the course.

For a fuller explanation of the requirement and objectives of general education, and a guide to the choice of specific subjects, students should obtain a copy of the free publication, *General Education Handbook*, which is widely available in schools.

Additional information for undergraduate students who first enrolled before 1996

Transitional arrangements

It is intended that no student will be disadvantaged by the change to the new General Education Program. The old Program had specific requirements to complete four session length subjects (or their equivalent) in designated categories A and B. The new General Education Program does not categorise subjects in the same way.

As a result, students who enrolled prior to 1996 will be given full credit for any General Education subjects completed up to the end of Session two 1995.

From the summer session of 1995-96, students will be required to satisfy the unfilled portion of their General Education requirement under the terms of the new Program.

The exemption of General Education requirements for some double or combined degree programs will continue to apply for students who enrolled in these exempt courses prior to 1996.

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 (professional practice in the case of Geomatic Engineering candidates) for such periods as are prescribed. In general, this training must be completed before 31 January in the year in which the degree is to be awarded.

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

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

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

Honours Class I
Honours Class II, Division I
Honours Class II, Division II

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

Graduate Study
Summary of Courses

The Faculty awards higher degrees as follows: Research - Doctor of Philosophy, Master of Engineering 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 specialisation), Master of Environmental Engineering Science and Master of Information 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).

The Master of Technology Management degree is a new multidisciplinary course approved by the UNSW Council in June 1996. The three faculties who have initiated this unique joint enterprise are the Faculties of Applied Science, Commerce and Economics, and Engineering. The course is built on the acknowledged strengths of these faculties in applied science, commerce and economics, engineering, technology and technology management. Further information the course is available in the Faculty of Applied Science 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%

4. 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**
Geomatic Engineering **1681**
Mechanical and Manufacturing Engineering **1662**

ME

Biomedical Engineering **2675**
Civil Engineering **2650**
Computer Science and Engineering **2665**
Electrical Engineering **2660**
Geomatic Engineering **2721**
Mechanical and Manufacturing Engineering **2692**

MSc

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

Doctor of Philosophy
PhD

This degree is awarded for a thesis considered to be a substantially original contribution to the subject concerned. The degree is becoming a prerequisite for research appointments in government and industrial research and development laboratories. Research for this degree may be taken at, or externally to, the University. However the Faculty recommends that periods of residency at the University totalling at least six months be included in the candidate's research program.

Admission Guidelines: A candidate for registration for the degree of Doctor of Philosophy should hold an honours degree from the University of New South Wales or an honours degree of equivalent standing from another approved university. 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 first year of candidature.

Master of Engineering/
Master of Science/
ME/MSc

These are research degrees in which a thesis embodies the result of an original investigation, or design, or engineering development. Candidates for the award of the degree of ME may be required to carry out a program of advanced study.

Admission Guidelines: A candidate for registration for the degree of Master of Engineering or Master of Science 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 first 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:

Internal Mode Delivery

MCompSc
Computer Science and Engineering **8680**

MBiomedE
Biomedical Engineering **8660**

MEngSc
Biomedical Engineering 8665
Computer Science and Engineering **8685**
Computational Engineering **8612.6000**
Construction Management **8612.1200**
Electrical Engineering **8501**
Engineering Construction and Management **8612.1000**
Geotechnical Engineering **8612.2000**
Geomatic Engineering **8652**
Industrial Engineering **8531**
Mechanical Engineering **8541**
Project Management **8612.1100**
Public Health Engineering **8612.5200**

Remote Sensing **8641**
Structural Engineering **8612.3000**
Transport Engineering **8612.4000**
Water Engineering **8612.5000**
Waste Management **8612.5100**

MEnvEngSc
Civil Engineering **8615**

MInfSc
Computer Science and Engineering **8508**

MTM
Master of Technology Management **8007***

External Mode Delivery

All external courses are offered only on a full fee paying basis.

MEngSc
Engineering Construction and Management **8617**
Waste Management **8614**
Water and Wastewater Treatment **8614**
Groundwater Investigations and Management 8614

MEnvEngSc
Civil Engineering **8618**

MBT
Business and Technology **8616**

**Fee paying course for which the course authority is the Faculty of Applied Science*

Master of Engineering Science MEngSc

The Master of Engineering Science is a Faculty-wide degree allowing for flexibility of choice between formal course work and research. The schools in the Faculty have developed recommended programs of study leading to specialisation in certain areas and further information is available under each School section in this handbook.

Candidates who enrolled from 1990 are required to complete a program totalling 120 credit points. 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 credit points for a project reports varies amongst schools, centres and departments.

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 credit points to ensure that the prerequisite background held is adequate for all subjects including those taken in other schools or institutions.

Period of Candidature: The minimum 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.

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 credit points. Candidates must usually complete a program totalling 96 credit points. 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 credit points should come from the subjects taken in that area.

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:

Internal Mode Delivery

Graduate Diploma in Engineering
Biomedical Engineering **5445**
Civil Engineering **5459**
Computer Science **5452**
Electrical Engineering **5458**
Electric Power Engineering **5435**
Geomatic Engineering **5492**
Industrial Management **5457**
Information Science **5453**
Industrial Engineering **5455**

Land Administration **5493**
Mechanical Engineering **5456**
Remote Sensing **5496**

External Mode Delivery

All external courses are offered only on a full fee paying basis.

Graduate Diploma in Engineering
Engineering Construction and Management **5454.1500**
Waste Management **5498**
Water and Wastewater Treatment **5498**
Groundwater Investigations and Management **5498**

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 candidates 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, and Graduate Diploma can be found in each School section. Not all electives are necessarily offered in any particular year.

Under the credit point system in operation in the Faculty, one credit point 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 credit points 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 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.

Research and Project Areas

Biomedical Engineering

Analysis of patient therapies
Arterial haemodynamics
Arterial morphometry
Artificial blood vessels
Automatic modulation of cardiovascular function
Bioactive materials
Biocompatibility: tissue/materials interactions
Biomaterials
Biomechanics of joints
Biomedical instrumentation and computer acquisition
Biomedical polymers
Bioprostheses
Cardiovascular effects of body
Cell separation technologies
Computer-aided histological analysis
Endothelial cell/biomaterial interactions
Extracorporeal therapies
Flow in collapsible tubes
Flow visualisation and measurement
Implantable sensors
Infection associated with medical devices
In vivo mechanisms of polymer degradation
Mechanisms of age related arterial degradation and hypertension
Medical image processing
Modelling of artificial kidney therapy
Modelling of cardiac electrical potentials
Modelling of mass transfer processes in medicine
Non-invasive blood pressure measurement
Nonlinear dynamical systems analysis
Orthopaedic applications of hydroxyapatite
Orthopaedic implants
Percutaneous access devices
Processing and interpretation of biomedical signals
Pulmonary image analysis
Pulsatile crossflow filtration
Ultrasonic distance measurement
Ventricular assist devices

CANCES

Industrial Computational Fluids and Heat Transfer
Complex turbulent flows and turbulence modelling
Forced convection and radiative heat transfer
Two-phase flows : gas/particle; fluid/particle; water/steam
Mineral processing flows
Erosion, particulate deposition and electrostatic precipitation
Computational wind engineering
Airconditioning and fire modelling
Computational (automatic) design
Computational aerodynamics and turbomachinery

Environmental Modelling
Atmospheric dynamics
Numerical weather prediction
Climate variability
Atmosphere-ocean interactions
Atmospheric Boundary layer studies
Meso-scale numerical modelling
Atmospheric-Land interactions
Wind erosion, soil moisture and wind breaks
Air quality

Finite Element Structural Analysis
Mechanical and manufacturing engineering
Large-scale static, dynamic and nonlinear FE analysis
Constitutive modelling for metals, adhesives and carbon fibre composites
Computational fracture mechanics
Material properties via inverse FE analysis
Biomedical analysis
Adaptive solution methodology and sparse matric algorithms

Civil and Environmental Engineering

Concrete Technology
Specification and quality control of concrete
Investigation of alternative cementitious materials
Examination of pozzolanic potential of indigenous materials
Utilisation of industrial waste materials in concrete
Chemistry and mineralogy of cement and lime stabilisation
Durability of concrete
High strength and high performance concrete
Ductility of concrete through the use of polymer fibres
Supplementary cementitous materials such as fly ash, slag and silica fume
Properties of polymer modified concrete

Concrete Structures
Time effects including creep and shrinkage in reinforced and prestressed concrete structures
Finite element modelling of reinforced concrete including beam-column-slab connections
Collapse load behaviour of reinforced concrete slabs
Durability and ductility of concrete structures
Non-metallic tendons for prestressed concrete applications
Behaviour and strength of slender reinforced concrete columns
Studies on high-strength concrete
Reinforced concrete deep beams
Partially prestressed concrete beams
Analysis and design of end blocks for post-tensioned beams
Strength of precast prestressed concrete planks
Continuous prestressed concrete structures

Composite Structures
Strength and time dependent characteristics of steel-concrete composite structures
Behaviour of composite beams in negative bending
Concrete - concrete composite members

Engineering Construction and Management
Construction operations. Equipment selection. Field layout. Productivity.
Systems studies, systems engineering
Construction management
Project management
Contracts, quality and risk management
Management of people
Engineering economics. Financial management
Time management. Asset management. Maintenance management
Marketing, strategic management

Environmental Fluid Mechanics
Two-fluid systems with small density differences
Pollutant dispersion
Stratified flows
Physics of inland and coastal waters
Turbulence in water bodies and the atmosphere
Atmosphere/ocean interactions
Computational algorithms
Numerical modelling

Environmental Microbiology
Microbiology of waste treatment (including composting),
Environmental pathogens
Wastewater recycle

Geotechnical Engineering
Shear strength of jointed rock, soft rock and clay soils
Expansive soils
Mine tailings disposal
Uncertainty in geotechnical engineering
Risk assessment for slopes and dams
Landfill design
Contaminant transport
Site remediation
Embankment dams
Landsliding - groundwater response to rainfall, progressive failure, probability of failure
Influence of soil fabric and mineralogy on properties
Predicting excavatibility of rock

Groundwater
Dryland salinity studies
Geophysical methods for contamination detection
Remote sensing using Landsat and Radar
Contaminated site assessment techniques
Pollutant movement in groundwater systems
Groundwater modelling

Hydraulics and Coastal Engineering
Open channel flow and hydraulic structures
Fluvial and estuarine hydraulics
Catchment drainage and water quality
Sediment transport
Wave action and coastal processes
Coastal structures and port engineering
Numerical and physical modelling

Hydrology
Methods of flood estimation
Design based on flood estimates
Economics of data collection
Assessment, modelling, forecasting of drought
Computational hydraulics
Rainfall-runoff relationships
Water quality
Urban drainage
Catchment management
Computer applications in hydrology
Fluid mechanics

Numerical Methods in Geomechanics
Finite element techniques and their applications in geotechnical engineering including static and dynamic loading
Numerical modelling of contaminant flow and flow in fractured and porous media
Numerical modelling of partially saturated flow
Numerical techniques in static and dynamic fracture mechanics and damage mechanics
Application of artificial intelligence and fuzzi-sets in geotechnical engineering

Pavement Engineering
Industrial and airport pavements
Pavement management and rehabilitation
Interlocking concrete block pavements
Accelerated trafficking studies of pavements and pavement materials
Constitutive relationships of soils and pavement materials
Pavement design and analysis

Public Health Engineering
Municipal wastewater and sludge treatment
Mathematical modelling of wastewater treatment
Low cost treatment systems
Water quality
Nutrient control in wastewater treatment
Management of water quality in municipal supplies
Water quality management
Potable, environmental and industrial identification and control of public health risks in water supply

Steel Structures
Thin walled sections and buckling of steel members
Crashworthiness of vehicles and components
Instability of structures
Elastoplastic analysis and shakedown of steel frames
Computer aided design of steel structures

Structural and Numerical Analysis, Geometric Modelling
Stability analysis using bubble functions
Optimal structural design
Non linear and large displacement analysis
Lightweight and large span structures
Finite element analysis of hyperbolic paraboloid cooling towers
Development and application of finite element techniques
Investigation of elastic stability

Timber Engineering and Masonry Structures
Timber shell structures
Dynamic behaviour of timber utility poles in car crashes
Non destructive testing of timber
Limit State design methods
Stress laminated timber bridges and design procedures for flat orthotropic plates
Finite element analysis of structural connection

Transport Engineering
Problems of land use and transport interaction
Theories of traffic structure and flow
Measurements, planning and control of traffic
Transport systems analysis
Transport and the environment - accidents, energy, intrusion, noise and pollution
Road and traffic noise
Transport and the community
Urban and rural transport system design
Economic evaluation of transport investments
Transport planning - local, urban, and regional systems
Investigations into transport economics, policy and decision making
Investigations of the geometric shape of the road alignment
Study of road alignment design in three dimensions

Water Resources Engineering
Interactions and processes involving particles and surfaces with application in the water and wastewater treatment industries and in natural and industrial aqueous systems
Experimental and computational studies of the fate and effects of pollutants
Hydro geochemistry of subsurface environments
Application of geographic information systems (GIS) to water resource management
Remote sensing in hydrologic modelling and resources management
Waste ManagementMr S Moore
Hazardous waste management
Modelling hazardous waste generation
Waste minimisation
Waste audits
Environmental management plans
High temperature incinerator
Solid waste management strategies
Transfer stations
Recycling incineration
Landfill management plans
Leachate generation and control

Computer Science and Engineering

Advanced Database System
Algorithm Animation
Applications of Machine Learning
Application of Logic Programming
Architectural Support for Languages and Operating Systems
Artificial Intelligence
Artificial Intelligence
Artificial Intelligence
Artificial Intelligence
Automatic Index Generation
Biology and Computers
Cognitive Design
Cognitive Modelling
Combinatorial Algorithms
Combinatorial Problems and Algorithms
Communication Protocols
Communication Systems
Computational Geometry
Computer Aided Design
Computer Architecture
Computer Assisted Learning Computer Graphics
Computer Organisation
Computer Vision
Computer Vision and Control for Robotics
Cooperative Systems
Database Management
Database Multimedia
Database Systems
Decision Making Under Uncertainty

Deductive Databases
Distributed Database Data Modelling
Distributed Database Systems
Distributed Operating System
Distributed Simulation
Document Analysis
Expert Systems
Fault Tolerant Computer Systems
Financial Applications of Neural Networks
Formal Methods
Formal Methods of Reasoning
Functional Programming
Functional Programming
Fuzzy Databases
Fuzzy Systems and Evidence Theory
Graph-theoretic Algorithms
Human Computer Interaction
Heterogeneous Computing
Mensurational Modelling
Image Processing
Image Processing
Implementation & Performance Modelling
Information Retrieval
Information Retrieval/Filtering
Integrated Circuit Design and Logic Testing
Knowledge Acquisition
Knowledge Based Systems
Knowledge Extraction from Training Neural Networks
Languages
Learning Algorithms
Learning Theory
Logic Programming
Logic Programming Systems
Machine Learning
Management of Uncertainty and Possibility Theory
Microprocessor Based Equipment
Model Based Reasoning
Multimedia
Multimedia Databases
Multimedia System
Multiprocessor Architectures
Natural Language Processing
Natural Language Understanding
Natural Language
Neural Networks
Neural Networks
Object Oriented Databases
Object Oriented Design
Object Oriented Technology
Operating Systems
Parallel and Distributed Systems
Parallel and Distributed Systems
Parallel and Distributed Computing
Parallel Languages
Parallel Processing
Parallel Software Engineering
Parallel Systems
Parsing & Translation
Pattern Recognition
Performance Specification
Persistent Objects
Plagiarism Detection
Planning
Production Systems, Knowledge Representation
Production Systems
Program Similarity
Program Transformation
Programming Environments
Programming Language Implementation
Query Language Testing
Query Processing
Real Time Systems
Reverse Engineering
Robotics
Scientific Computing
Signal Recognition
Semiconductor Device Simulation
Software Engineering
Software Engineerin
Software Project Management
Software Process Improvement
Specification and Development of Concurrent Systems
Specification and Refinement
Specification and Verification of Real-Time Concurrent Systems
Theory of Computation
Temporal Logic
Theory of Database Systems
Virtual Environments
Visualisation
VLSI Systems

Electrical Engineering

Communications

(i) Optical Communications
Optical communications
Optical fibres and integrated optics
Electro-optic devices
Sensors
Nonlinear optical switching
Optical solitons

(ii) Microwaves and Antennas
Microwave circuits and devices
Microwave measurements and electronics
Antennas and phased arrays
CAI in electromagnetic applications
SAW devices
Nonlinear effects in optical fibres
Soliton Propogation in optical fibres

(iii) Signal Processing
Signal processing and analysis
Active and adaptive filtering
Digital Filters
Digital signal processor chip
Acoustic and seismic signal processing
Speech processing and coding
Digital image processing andvideo signal processing
SAW Signal Processing

(iv) Digital Communications
Digital communications
Digital radio and modulation methods

(v) Communications Networks

Computer communications and local area networks
New architectures for local area

Network reliability and service availability
BISDN, ATM protocols

(vi) Communications Systems
Radar and navigational aids
Land & Satellite Mobile Communications
Mobile satellite communications

Electric Power
(i) Power Systems
Power System analysis
Power System Protection
Stability,Dynamics and Contro
Distribution System Planning and Operation
Optimisation of Hydro-electric Power Systems
Electromagnetic Transient Analysis
Static VAR Compensation
Power System Planning and Economics
Load Management and Control
Renewable Energy Sources Photovoltaic Systems
Remote area supply
Harmonic
Flexible AC Transmission System

(ii) Electrical Power Equipment and Utilization
High Voltage and high current phenomena
Insulating material application
Voltage disturbances in LV and MV systems
Electrical measurements and data acquisition
Electrical machines and drives
Arcing fault characteristics
Partial discharge detection and location
Gaseous discharges and insulation
Equipment for hazardous almospheres
Synthetic loading of machines
Computer aided teaching
Electrical machine modelling
Electrical safet
Vector control of induction and synchronous motor drive

(iii) Power Electronics
DC/DC converters
High frequency power transformers
Inverters for machine drives
Microprocessor control of power electronics
Variable speed drives
Dynamics of drives, speed observer techniques
Power electronic simulation studie
Electronic commutation
Remote area supplies

Electronics
Semiconductor device physics
Novel semiconductor devices
Integrated circuit design
Integrated circuit technology
Optical and infrared detector arrays
Microelectronic scnsors
Photovoltaic solar energy conversion
Silicon solar cells
Computer-aided IC design
Plasma processing
Integrated circuits for advancedsignal processing
Photovoltaic module design
Microstructured devices
GaAs devices

Systems and Control
Multivariable Control, simulation, modelling, expert systems in control design, advanced control of power plant, computer aided design and optimal control

Cybernetic engineering and advanced robotics: signal, pattern, image and scene, analysis and processing, brain modelling, neural computing and learning machines, vision robotics and assembly, adaptive control, hierarchical control, formal systems and functional representation

Robust control, computation issues in control, adaptive control

Adaptive and multivariable systems, multirate control, robust digital control, robust digital control, motion control systems

Digital and adaptive control, real-time computing, multivariable control

Biomedical engineering, biological signal analysis, physiological systems modelling and analysis, computer hardware and software, data acquisition, signal processing ecg analysis

Control and simulation, digital system and digital signal processing, physiological system modelling, biological signal processing, computer modelling of information processing, neural computing and learning machines, adaptive control

Robust adaptive control Theory and Applications, Robot control, Fuzzy control systems, Neural Networks for identification and control, Multirate digital control systems, Adaptive noise cancellation, Process control systems

Geomatic Engineering

Analysis of deformation measurements
Applications of inertial technology
Computer assisted mapping
Computer controlled surveying
Coordinate transformation
Digital image analysis for photogrammetry and remote sensing
Digital Elevation models from aerial and satellite images
Electronic distance measurement
Geoid determination
Geodesy
Geopotential model testing
GPS geodynamics
GPS and GIS
GPS heighting
GPS surveying
Height datum determination
High-precision surveying
Imaging radar
Land information management
Land use and urban monitoring
Least squares estimation and alternatives
Machine vision applications of digital photogrammetry
Metrology and dimensional measurement
Monitoring of structures and terrain
Photogrammetry
Precise orbit determination

Precise GPS navigation
Quality issues in land information systems
GPS Data Management
Radar altimetric analysis for oceanography
Remote sensing
Satellite geodesy
Survey network adjustment
Voice recognition for surveying instruments

Mechanical and Manufacturing Engineering

Aerospace Engineering
Composites
Finite element analysis
Fatigue, fracture mechanics and damage tolerance
Computational aerodynamics
Unsteady boundary layers
Turbulence
Laser anemometry
Flow simulation
Compressor aerodynamics
Design of aircraft
Aerospace CAM/CA
Initial project design
Aerospace policy studies
Distributed logic satellite control systems

Applied Mechanics
Mechanics of solids
Stress analysis
Fracture mechanics
Impact mechanics
Spatial and planar linkages
Mechanics of machines
Rotor bearing dynamics
Vibrations
Metallic friction, wear and lubrication
Hydrodynamic dampers
Noise and vibration control
Creep analysis

Design
Biomechanics
Bulk materials handling
Design of surgical equipmen
Computer aided design
Concurrent design
Development of engineering design
Design methodology
Design projects: analysing testing and development for industry
Maintenance management
Wind energy systems
Design with mechatronics
Life assessment

Fluid and Thermal Engineering
Computational fluid dynamics
Solidification in earth and microgravity
Energy conversion and energy conservation
Engine performance and emissions
Heat transfer
Gas dynamics, transonic flow ,shock waves
Optical measuring methods
Pyrolysis and fires modelling
Refrigeration and air conditioning
Slurries and conveying of solid dust by gases
Solar energy
Two-phase flow with and without heat transfer

Industrial Technology and Management
Production planning and control
Job sop scheduling
Artificial intelligence in manufacturing management
Experimental and theoretical investigations of the followingprocesses: machining, electricdischarge machining, laser cutting
Performance of single and multipointDr Mathewcutting tools including tool life andeconomics of machining
Properties of materials at highrates of strain
Engineering design analysis and tolerance technology
Quality function deployment
Metrology studies
Flexible fixtures
Applications of genetic algorithms and neural nets in manufacturing
Intelligent control of manufacturing systems
Design for manufacture
Ecologically sustainable manufacturing techniques
Cellular manufacturing strategies
Concurrent engineering
CAD/CAM
Computer-integrated manufacturing
Machine vision for manufacturing inspection
Performance measures
Quality management
Human factors in technology and society

Mechatronics
Applications of AI in engineering
Computer interfacing
Electromagnetic systems in manufacturing
Logic programming
Microcomputer control
Neural nets
Reliability engineering
Robotics and manufacturing
Active steering
Metal spinning
Welding research

Naval Architecture

Computer-aided ship design
Ships design methodology
Hydrodynamics of planing surfaces
Hydrodynamics of high-speed ferries, catamarans, hovercraft, hydrofoils,surface-effect ships
Problems in wave resistance
Boundary element methods
Water jets
Light weight ship structures
Nonlinear structural analysis
Resistance
Propulsion
Stability

Remote Sensing and GIS

Incorporation of auxiliary data into classification procedures
Urban Area studies
Monitoring land use change using remotely sensed data
Determining the characteristics of surface reflectance
Analysis of image and map quality
Application of satellite imagery to small scale mapping
Multispectral linear transformations
Application of spaceborne synthetic aperture radar data
Application of aircraft and satellite data to arid land studies
Application of satellite data to geological studies
Synergism of radar, visible and infrared remotely sensed data
Analysis of high resolution SPOT and Landsat TM data
Application of remote sensing to pollution and environmental monitoring
Artificial intelligence
Forest inventory and monitoring
Visualisation
Multimedia
Analysis of errors in DEM determination from radar interferometry
Development of a geographic information probability system (GIPS)
Vertical topology in GIS
Quality issues in hydrographic information systems
GIS in transport planning

School of Civil Engineering

Head of School
Professor R.I. Gilbert

Executive Assistant to Head of School
Mr G.R. Mostyn

Senior Administrative Officer
Ms K.M. Irvine

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, rock, dam and pavement engineering, geomechanics and environmental geomechanics); **Structural Engineering** (structural analysis, structural design and concrete and materials technology); **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 the Heavy Structures Laboratory at Govett Street, Randwick and the Water Research Laboratory at King Street, Manly Vale. The latter complex houses the School's 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 in Civil Engineering (BE) and Bachelor of Engineering in Environmental Engineering (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 all 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 an entire academic year.

In 1996 revised courses for BE in Civil Engineering and BE in Environmental Engineering were introduced. Students enrolled prior to 1996 will continue in the old courses. Details follow on the next two pages.

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

Five-year full-time combined courses **3730** leading to the award of the degrees of Bachelor of Engineering in Civil Engineering and Bachelor of Science are offered. Five-year full-time combined courses **3621** and **3626** leading to the award of the degrees of Bachelor of Engineering in Civil and Environmental Engineering, respectively, and Bachelor of Arts (BE BA) will be introduced for the first time in 1997.

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, computational engineering, engineering construction and management, project management, construction management, environmental engineering, coastal engineering, geotechnical engineering, groundwater investigations and management, hydrology and water resources, public health engineering, structural engineering, transport engineering, waste management, water and wastewater treatment, water quality management and water engineering. Within the Master of Engineering Science and Graduate Diploma courses, students may undertake construction management, project management and waste management by distance learning. Fees are payable for the distance learning courses.

Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering **2650,** Master of Science **2750** and Doctor of Philosophy **1630.**

Undergraduate Study

Course Objectives

The broad objective of the School's undergraduate courses is to develop well educated graduates with the basic skills, attributes and knowledge required to practise as professional engineers. The desired skills are those that enable graduates to be:-

- problem solvers
- critical thinkers
- life long learners
- good communicators
- team players
- independent investigators
- effective managers
- self motivated
- economically, environmentally and socially aware.

It is intended that these attributes are developed in students at the same time that they gain knowledge in a broad range of disciplines. In addition, an objective of the course is to provide the skills and knowledge in a social context. Integrating subjects ie. engineering practice, have been introduced to achieve this.

Honours

Honours will be awarded to students who have achieved above average results. A weighted average is calculated for each student. A weighting factor for each subject session hour is applied as follows:

- Year 1 x1
- General Education x1
- Year 2 x2
- Year 3 x4
- Year 4 x5

Industrial training has a nominal value of 3 session hours. For combined degree courses only the standard Civil Engineering subject results are used in the calculation. A weighted average mark of 65-69 will result in a recommendation for Honours 2/2. A weighted average mark of 70-74 will result in a recommendation for Honours 2/1. A weighted average mark of 75 and above will result in a recommendation for Honours 1.

Recognition

Both the BE in Civil Engineering and the BE in Environmental Engineering are fully accredited by the Institution of Engineers, Australia, meeting the examination requirements for admission to graduate and corporate membership of the Institution. Substantial or complete recognition is accorded to the BE degree courses by overseas engineering institutions.

Industrial Experience

Industrial experience is an integral part of the courses. This can be taken within Australia or overseas. Students must complete at least sixty days of approved industrial experience. Students are strongly recommended to gain as much industrial experience as possible. Students who have had suitable experience in industry prior to commencement may qualify for exemption from the Year 4 Industrial Training subject.

Computing Requirements

Information regarding recommended computing equipment for the courses offered by the School is available from the School Office.

Course Outlines

Civil Engineering offers opportunities to become involved in projects which enhance the overall quality of life. Civil engineers design, construct, manage, operate and maintain the infrastructure that supports modern society including buildings, bridges, roads and highways, tunnels, airfields, dams, ports and harbours, railways, new mines, water supply and sewerage schemes, irrigation systems and flood mitigation works. The profession is very broad and affords opportunities for involvement in many specialist activities.

3620
Civil Engineering - Full-time Course

Bachelor of Engineering
BE (Civil)

New course curriculum introduced for students commencing from 1996.

		HPW S1	HPW S2	CP
Year 1				
CHEM1808	Chemistry 1 CE	0	5	**12.5**
CIVL1011	Civil Engineering Practice 1	2	4	**22.5**
CIVL1015	Computing	4	0	**10**
CIVL1312	Statics	3	0	**7.5**
CIVL1313	Dynamics	0	2	**5**
CIVL1314	Mechanics of Solids	0	3	**7.5**
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	**15**
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	**15**
PHYS1979	Physics 1 CE	5	0	**12.5**

Total HPW Session 1 20
Total HPW Session 2 20
Total Credit Points 107.5

Year 2				
CIVL2011	Civil Engineering Practice 2	4	4	**30**
CIVL2116	Engineering Construction	2	2	**10**
CIVL2312	Introduction to Structures	2	0	**5**
CIVL2313	Structural Analysis 1	0	3	**7.5**
CIVL2314	Engineering Materials	2	3	**12.5**
CIVL2515	Water Engineering 1	0	3	**7.5**
GMAT0442	Surveying for Civil Engineers	3	0	**7.5**
GMAT0491	Survey Camp	(3)	0	**7.5**
MATH2019	Engineering Mathematics 2CE	3	3	**15**
MATH2869	Applied Statistics SC	2	0	**5**
General Education subject/s		2	2	**15**

Total HPW Session 1 20 (3)
Total HPW Session 2 20
Total Credit Points 122.5

		HPW S1	HPW S2	CP
Year 3				
CIVL3011	Civil Engineering Practice 3	4	4	30
CIVL3015	Engineering Computations	2	2	**10**
CIVL3116	Engineering Management 1	2	2	**10**
CIVL3214	Geotechnical Engineering 1	3	3	**15**
CIVL3312	Structural Engineering 1	5	0	**12.5**
CIVL3313	Structural Engineering 2	0	5	**12.5**
CIVL3418	Transport Engineering 1	0	2	**5**
CIVL3517	Water Engineering 2	3	3	**15**
General Education subject		2	0	**7.5**

Total HPW Session 1 21
Total HPW Session 2 21
Total Credit Points 117.5

Year 4				
CIVL4008	Industrial Training	0	0	**0**
CIVL4011	Civil Engineering Practice 4	4	4	**30**
CIVL4018	Honours Thesis	(3)	(3)	**(15)**
CIVL4116	Engineering Management 2	2	0	**5**
CIVL4214	Geotechnical Engineering 2	3	0	**7.5**
CIVL4312	Structural Engineering 3	3	0	**7.5**
CIVL4413	Transport Engineering 2	3	0	**7.5**
CIVL4515	Water Engineering 3	3	0	**7.5**
General Education subject		2	0	**7.5**
Plus two of the following five elective majors:				
CIVL4119	Construction Major	0	8	**20**
CIVL4219	Geotechnical Major	0	8	**20**
CIVL4319	Structures Major	0	8	**20**
CIVL4419	Transport Major	0	8	**20**
CIVL4519	Water Major	0	8	**20**

Total HPW Session 1 20(3)
Total HPW Session 2 20(3)
Total Credit Points 112.5 (127.5)

3620
Civil Engineering - Full-time Course
Bachelor of Engineering
BE (Civil)

Old course curriculum only for students enrolled prior to 1996.

There is no further entry into Years 1or 2 of the course.

Year 3				
CIVL3106	Engineering Computations	2	2	**10**
CIVL3203	Structural Analysis	3	3	**15**
CIVL3303	Structural Design	4	4	**20**
CIVL3402	Geotechnical Engineering 1	3	3	**15**
CIVL3505	Hydraulics 2	3	3	**15**
CIVL3601	Engineering Management 1	2	2	**10**
CIVL3705	Water Resources	3	3	**15**
CIVL3804	Transport Engineering	2	2	**10**
General Education subject/s		2	2	**15**

Total HPW Session 1 24
Total HPW Session 2 24
Total Credit Points 125

		HPW S1	HPW S2	CP
Year 4				
CIVL4006	Industrial Training	0	0	**0**
CIVL4101	Engineering Management 2	2	0	**5**
CIVL4203	Structural Engineering	4	0	**10**
CIVL4306	Engineering and the Environment	4	0	**10**
CIVL4403	Materials Engineering 2	3	0	**7.5**
CIVL4502	Geotechnical Engineering 2	3	0	**7.5**
CIVL4605	Water Supply and Wastewater Disposal	3	0	**7.5**
CIVL4704	Highway and Pavement Engineering	3	0	**7.5**
CIVL4906	Project/Thesis	1	6	**17.5**
Plus two of the following five elective majors:				
CIVL4811	Construction Major	0	9	**22.5**
CIVL4822	Geotechnical Major	0	9	**22.5**
CIVL4833	Structures Major	0	9	**22.5**
CIVL4844	Transport Major	0	9	**22.5**
CIVL4855	Water Major	0	9	**22.5**

Total HPW Session 1 **23**
Total HPW Session 2 **24**
Total Credit Points **117.5**

3625
Environmental Engineering - Full-time Course

Bachelor of Engineering
BE (Environmental)

New course curriculum introduced for students commencing from 1996.

Environmental engineers are concerned with the environmental impact of engineering activities. They apply their broad knowledge of engineering and environmental processes in identifying environmental problems and in developing effective solutions to them. They also coordinate the activities of specialist groups such as biologists, ecologists and geologists within major projects. The discipline of environmental engineering embraces parts of civil engineering, with emphasis on management, systems design, water, geotechnical and transport engineering and construction, together with aspects of chemical engineering, applied and biological sciences and environmental studies.

		HPW S1	HPW S2	CP
Year 1				
CHEM1101	Chemistry 1A	6	0	**15**
CHEM1201	Chemistry 1B	0	6	**15**
CIVL1015	Computing	0	4	**10**
CIVL1312	Statics	3	0	**7.5**
CIVL1710	Environmental Engineering Practice 1	3	3	**22.5**
GEOG1031	Environmental Processes	0	4	**15**
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	**15**
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	**15**
PHYS1979	Physics 1CE	5	0	**12.5**

Total HPW Session 1 **23**
Total HPW Session 2 **23**
Total Credit Points **127.5**

		HPW S1	HPW S2	CP
Year 2				
BIOS1201	Molecules, Cells and Genes	0	6	**15**
CEIC0010	Mass Transfer and Materials Balance	2	2	**10**
CIVL2321	Engineering Mechanics and Materials	3	3	**15**
CIVL2515	Water Engineering 1	0	3	**7.5**
CIVL2710	Environmental Engineering Practice 2	4	4	**30**
INDC4120	Chemistry of the Industrial Environment	3	0	**7.5**
MATH2019	Engineering Mathematics 2CE	3	3	**15**
MATH2869	Applied Statistics SC	2	0	**5**
General Education subject/s		4	0	**15**

Total HPW Session 1 **21**
Total HPW Session 2 **21**
Total Credit Points **120**

		HPW S1	HPW S2	CP
Year 3				
BIOS3301	Population and Community Ecology for Environmental Engineers	0	3	**7.5**
CEIC0050	Atmospheric and Process Chemistry	3	0	**7.5**
CIVL3015	Engineering Computations	2	2	**10**
CIVL3116	Engineering Management	2	2	**10**
CIVL3214	Geotechnical Engineering 1	3	3	**15**
CIVL3428	Transport and Noise Engineering	1	2	**7.5**
CIVL3517	Water Engineering 2	3	3	**15**
CIVL3521	Principles of Aquatic Chemistry	0	3	**7.5**
CIVL3710	Environmental Engineering Practice 3	4	4	**30**
General Education subject/s		4	0	**15**

Total HPW Session 1 **22**
Total HPW Session 2 **22**
Total Credit Points **125**

		HPW S1	HPW S2	CP
Year 4				
CEIC0040	Unit Operations in the Process Industries	2	2	**10**
CIVL4522	Environmental Water Engineering	3	2	**12.5**
CIVL4523	Transport and Fate of Pollutants in Coastal and Groundwater Environments	3	0	**7.5**
CIVL4710	Environmental Engineering Practice 4	4	4	**30**
CIVL4717	Industrial Training	0	0	0
CIVL4718	Honours Thesis	(3)	(3)	**(15)**
CIVL4720	Waste Management and Site Remediation	3	0	**7.5**

		HPW S1	HPW S2	CP
CIVL4730	Environmental Management	4	0	10
GMAT0753	Introduction to Spatial Information Systems	2	0	5
Plus two of the following five elective majors:				
CEIC0030	Environmental Protection in the Process Industries	0	6	15
CIVL4229	Geotechnical Major - Environmental	0	6	15
CIVL4429	Transport Major - Environmental	0	6	15
CIVL4529	Water Major - Environmental	0	6	15
Geography major consisting of two of the following:				
GEOG4130	River Management	0	4	15
GEOG4300	Vegetation Management	4	0	15

Total HPW Session 1 21(3)
Total HPW Session 2 20(3)
Total Credit Points 112.5 (127.5)

3625
Environmental Engineering - Full-time Course

Bachelor of Engineering
BE (Environmental)

Old course curriculum only for students enrolled prior to 1996.

There is no further entry into Years 1and 2 of the course.

Year 3

		HPW S1	HPW S2	CP
BIOS3301	Population and Community Ecology for Environmental Engineers	0	3	7.5
CEIC0010	Mass Transfer and Material Balance	2	2	10
CIVL3007	Environmental Fluid Mechanics	3	3	15
CIVL3017	Management for Environmental Engineers 1	2	2	10
CIVL3106	Engineering Computations	2	2	10
CIVL3402	Geotechnical Engineering	3	3	15
CIVL3705	Water Resources	3	3	15
CIVL3804	Transport Engineering	2	2	10
CIVL4037	Environmental Values	2	0	5
GEOL9110	Hydro and Environmental Geology	0	3	7.5
General Education subject/s		4	0	15

Total HPW Session 1 23
Total HPW Session 2 24
Total Credit Points 115

		HPW S1	HPW S2	CP
Year 4				
CEIC0020	Fluid/Solid Separation	0	2	5
CIVL4006	Industrial Training	0	0	0
CIVL4007	Waste Management	3	0	7.5
CIVL4057	Management for Environmental Engineers 2	2	0	5
CIVL4067	Legislative Aspects of the Environment	0	3	7.5
CIVL4605	Water Supply and Wastewater Engineering	3	0	7.5
CIVL4907	Project/Thesis	1	6	17.5
GEOG3042	Environmental Impact Assessment	4	0	15
GEOL9120	Groundwater Contaminant Transport	3	0	7.5
GMAT0752	Remote Sensing Techniques and Applications	4	0	10
INDC3070	Instrumentation and Process Control*	0	3	7.5
Plus two of the following five elective majors:				
CEIC0030	Environmental Protection in the Process Industries	0	6	15
CIVL4017	Water Engineering	0	6	15
CIVL4027	Geotechnical Engineering	0	6	15
CIVL4047	Transport Engineering	0	6	15
Geography major consisting of two of the following:				
GEOG4300	Vegetation Management	4	0	15
GEOG4130	River Management	0	4	15

Total HPW Session 1 23
Total HPW Session 2 23
Total Credit Points 127.5

**CIVL4077 will be substituted for INDC3070 in 1997.*

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

These programs will be affected by course revisions to 3620. Please consult the School of Civil Engineering for advice.

3730.1000
Geography and Environmental Chemistry

Year 1
CHEM1808
CIVL1011, CIVL1015, CIVL1312, CIVL1313, CIVL1314
MATH1131 or MATH1141
MATH1231 or MATH1241
PHYS1979

Year 2
CHEM2011, CHEM2031, CHEM2041
CIVL2116, CIVL2312, CIVL2313, CIVL2314
GEOG1031 and any other Year 1 Geography subject
MATH2019, MATH2869

Year 3
CHEM3311
CIVL2011, CIVL2515, CIVL3015, CIVL3312, CIVL3313
GMAT0442, GMAT0491
General Education subject/s

Year 4
CIVL3011, CIVL3116, CIVL3214, CIVL3418, CIVL3517
GEOG3011, GEOG3042, GEOG3211
At least 2 subjects chosen from:
GEOG2021, GEOG3032, GEOG2051, GEOG3062

Year 5
Choose 2 subjects from appropriate undergraduate offerings in the Sciences Handbook at Level II or higher
CIVL4011, CIVL4017, CIVL4018,** CIVL4116, CIVL4214, CIVL4312, CIVL4413, CIVL4515
Two of the following subjects:
CIVL4119, CIVL4219, CIVL4319, CIVL4419, CIVL4519
***Honours students only*

3730.2000
Physics with Mathematics

Year 1
CHEM1808
CIVL1011, CIVL1015, CIVL1312, CIVL1313, CIVL1314
MATH1131 or MATH1141
MATH1231 or MATH1241
PHYS1002

Year 2
CIVL2116, CIVL2312, CIVL2313, CIVL2314
MATH2510, MATH2520, MATH2100, MATH2120
MATH2869
PHYS2011, PHYS2021, PHYS2031

Year 3
CIVL2011, CIVL2515, CIVL3312, CIVL3313
GMAT0442, GMAT0491
MATH2501
PHYS2001, PHYS3021, PHYS3041
General Education subject/s

Year 4
CIVL3011, CIVL3116, CIVL3214, CIVL3418, CIVL3517
PHYS3030
Choose 1 unit from: PHYS3631, PHYS3110, PHYS3010, PHYS3050
Choose 2 Level II or Level III Mathematics subjects in the Sciences Handbook.

Year 5
CIVL4011, CIVL4017, CIVL4018,** CIVL4116, CIVL4214, CIVL4312, CIVL4413, CIVL4515
Two of the following subjects:
CIVL4119, CIVL4219, CIVL4319, CIVL4419, CIVL4519
Choose 1 Level II subject or higher from appropriate undergraduate offerings in the Sciences Handbook.
***Honours students only*

3730.3000
Computing with some Mathematics

Year 1
CHEM1808
CIVL1011, CIVL1015, CIVL1312, CIVL1313, CIVL1314
MATH1131 or MATH1141
MATH1231 or MATH1241
PHYS1979

Year 2
CIVL2011, CIVL2312, CIVL2313, CIVL2314
COMP1011, COMP1021
MATH2501+, MATH2510+, MATH2520+, MATH2869

Year 3
CIVL2116, CIVL2515, CIVL3312, CIVL3313
GMAT0442, GMAT0491
COMP2011, COMP2021, COMP2031
MATH2100+, MATH2120+
General Education subject/s
Choose 0.5 Level II or Level III Mathematics subject from the Sciences Handbook.

Year 4
CIVL3011, CIVL3116, CIVL3214, CIVL3418, CIVL3517
COMP3121
Choose three subjects, at least one of which is a Computer Science Unit, from COMP3211, COMP3231, COMP3311 or Level II or Level III Mathematics subjects from the Sciences Handbook.

Year 5
CIVL4011, CIVL4017, CIVL4018,** CIVL4116, CIVL4214, CIVL4312, CIVL4413, CIVL4515

Two of the following subjects:
CIVL4119, CIVL4219, CIVL4319, CIVL4419, CIVL4519
Choose 1 Level 11 subject or higher from appropriate undergraduate offerings in the Sciences Handbook.
Choose 1 subject from the Sciences Handbook at Level II or III.

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

***Honours students only*

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

Students enrol in the Bachelor of Engineering in Civil Engineering Course **3620** which is administered by the School of Civil Engineering. The first three and a half years of the combined degree course are therefore identical to course **3620**. After completing 7 Sessions of this course, students may apply to enter the Bachelor of Engineering in Mining Engineering Course **3146** which is administered by the School of Mines in the Faculty of Applied Science and aim to complete the mining requirements in 3 additional Sessions.

Students considering this option should discuss the above arrangements with the relevant Course Authorities.

4775
BE LLB in Civil Engineering and Law – Full-time Course

This course is administered by the Faculty of Law and candidates enrol through the Faculty of Law. Further information can be obtained from the Faculty of Law Handbook.

Year 1
CHEM1808
CIVL1011, CIVL1015, CIVL1312, CIVL1313, CIVL1314
MATH1131 or MATH1141
MATH1231 or MATH1241
PHYS1979

Year 2
CIVL2011,CIVL2312, CIVL2313, CIVL2314, CIVL2515
LAWS1120, LAWS7410
MATH2019, MATH2869
GMAT0442, GMAT0491

Year 3
CIVL2116, CIVL3011, CIVL3015, CIVL3116, CIVL3214, CIVL3312, CIVL3313, CIVL3418, CIVL3517
LAWS1420, LAWS2140

Year 4
CIVL4011, CIVL4018,** 8CIVL4214, CIVL4312, CIVL4413, CIVL4515 taken concurrently with LAWS3410
LAWS1610, LAWS2160, LAWS3010
Plus one of the following elective majors:
CIVL4119, CIVL4219, CIVL4319, CIVL4419, CIVL4519

Year 5
LAWS1010, LAWS4010,LAWS8320, LAWS8820, LAWS2150, LAWS6210, LAWS7420, LAWS7430

Law electives to value 30 credit points.

Year 6
Law electives to the value of 120 credit points.

***Honours students only (Civil)*

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, coastal engineering, computational engineering, engineering construction and management, project management, construction management, environmental engineering, geotechnical engineering, groundwater investigations and management, hydrology and water resources, public health engineering, structural engineering, transport engineering, waste management, water and wastewater treatment, water quality management and water engineering. Within the Master of Engineering Science and Graduate Diploma courses, students may undertake construction management, project management and waste management by distance learning. Fees are payable for the distance learning courses.

Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering **2650,** Master of Science **2750** and Doctor of Philosophy **1630.**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 computational engineering, engineering construction and management, environmental engineering, geotechnical engineering, public health engineering, structural engineering, transport engineering, waste management and water engineering.

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,** Master of Science **2750** and Doctor of Philosophy **1630.**

Course Work Programs

Master of Engineering Science and Master of Environmental Engineering Science candidates are required to complete a program totalling 120 credit points which may include a 36 credit point project. Most subjects are worth 12 credit points. Subject to approval candidates may undertake some subjects from other schools in the faculty, in other faculties or at other universities.

All students enrol in a particular program or specialisation. Usually a student specialises by completing 84 credit points of coursework plus a 36 credit point project within a particular discipline. Some programs specify core subjects. Elective subjects must be approved by the course co-ordinator.

Graduate Diploma candidates are required to complete a program of study totalling 96 credit points of coursework and may choose from a range of subjects in the discipline of their choice. All subjects offered in the Masters program can also be taken in the Graduate Diploma program subject to approval by the course coordinator. In some cases 48 credit points may be derived from approved undergraduate subjects.

It should be noted that some candidates who have partially completed the requirements for Graduate Diploma may be considered for upgrading to the relevant Masters program with advanced standing. Further enquiries should be made with the School.

8612
Master of Engineering Science
MEngSc

8612.1000 Engineering Construction and Management
8612.1100 Project Management
8612.1200 Construction Management

Subjects are selected from the following list:

Management

CIVL9701	Economic Decision Making in Engineering
CIVL9702	Project Planning and Control
CIVL9703	Quality and Quality Systems
CIVL9706	Human Resources Management
CIVL9707	Contracts Management
CIVL9710	Engineering Risk Management
CIVL9714	Special Topic in Engineering Management
CIVL9725	Engineering Financial Management
CIVL9726	Legal Studies and Professional Practice
CIVL9731	Project Management Framework

Construction

CIVL9723	Construction Design
CIVL9724	Construction Engineering and Technology
CIVL9727	Construction Estimating and Tendering
CIVL9728	Special Topic in Construction

8612.2000 Geotechnical Engineering

The following subjects are recommended for students who are majoring in Geotechnical Engineering:

CIVL9788	Site Investigations
CIVL9790	Stability of Slopes
CIVL9791	Foundation Engineering 1
CIVL9793	Geomechanics

Plus a selection of subjects from:

CIVL9777*	Numerical Methods in Geomechanics
CIVL9783	Pavement Materials
CIVL9784	Pavement Design
CIVL9785	Pavement Evaluation and Maintenance
CIVL9786*	Industrial and Heavy Duty Pavements
CIVL9792	Foundation Engineering 2
CIVL9799	Environmental Geomechanics
CIVL9860	Investigation of Groundwater Resources
CIVL9861	Environmental and Engineering Geophysics
CIVL9880	Groundwater Modelling
GEOL9030	Geological Engineering
GEOL9060	Environmental Geology

** These subjects are not offered every year.*

8612.3000 Structural Engineering

Students must complete a 36 credit point project in the field of structural engineering plus at least 60 credit points from the following subjects:

CIVL9802	Elastic Stability 1
CIVL9804	Vibration of Structures 1
CIVL9806	Prestressed Concrete 1
CIVL9807	Prestressed Concrete 2
CIVL9809	Reinforced Concrete 1
CIVL9810	Reinforced Concrete 2
CIVL9814	Analysis of Plates and Shells
CIVL9818	Bridge Design 1
CIVL9819	Bridge Design 2
CIVL9820	Structural Analysis and Finite Elements 1
CIVL9821	Structural Analysis and Finite Elements 2
CIVL9822	Steel Structures 1
CIVL9823	Steel Structures 2
CIVL9824	Advanced Concrete Technology
CIVL9784*	Pavement Design
CIVL9791*	Foundation Engineering 1

**Only one of these subjects can be included in the total of 60 credit points*

8612.4000 Transport Engineering

Subjects are selected from the following list:

CIVL9402	Transport, Environment, Community
CIVL9403	Theory of Land Use Transport Interaction
CIVL9405	Urban Transport Planning Practice
CIVL9407	Transport Systems Design (Non-Urban)
CIVL9408	Transport Systems Design (Urban)
CIVL9410	Highway Engineering Practice
CIVL9414	Transport Systems Part 1
CIVL9415	Transport Systems Part 2
CIVL9416	Traffic Engineering
CIVL9417	Transport and Traffic Flow Theory
CIVL9420	Special Topic in Transport Engineering
SAFE9544	Traffic Safety

8612.5000 Water Engineering

Specialisation is possible within the following six areas:

- Waste Management
- Water and Wastewater Treatment
- Groundwater Investigations and Management
- Coastal Engineering and Management
- Hydrology and Water Resources
- Water Quality Management

Each of the above specialised areas has a requirement of five compulsory core subjects with elective subjects to be chosen either from core subjects in alternative speciality areas listed below, from additional (non-core) subjects listed below or (subject to course coordinator's approval) from other courses offered at UNSW.

Subjects offered and details of each speciality areas core requirements are given below:

Specialisation Area Core Subject Requirements

Waste Management

CIVL9851	Unit Operations in Public Health Engineering
CIVL9872	Solid Waste Management
CIVL9881	Hazardous Waste Management
CIVL9884	Environmental Engineering Science 1
CIVL9885	Environmental Engineering Science 2

Water and Wastewater Treatment

CIVL9851	Unit Operations in Public Health Engineering
CIVL9855	Water and Wastewater Analysis and Quality Requirements
CIVL9856	Water Treatment
CIVL9857	Wastewater Treatment and Disposal
CIVL9884	Environmental Engineering Science 1

Groundwater Investigations and Management

CIVL9860	Investigation of Groundwater Resources
CIVL9875	Hydrological Processes
CIVL9891	Groundwater Contamination and Remediation
GEOL9010	Groundwater Environments
GEOL9051	Hydrogeochemistry

Coastal Engineering and Management

CIVL9835	Coastal Engineering 1
CIVL9836	Coastal Engineering 2
CIVL9858	Water Quality Management
CIVL9863	Estuarine Hydraulics
CIVL9875	Hydrological Processes

Hydrology and Water Resources

CIVL9860	Investigation of Groundwater Resources
CIVL9866	Flood Estimation for Design
CIVL9867	Flood Modelling
CIVL9875	Hydrological Processes
CIVL9876	Water Resource Modelling

Water Quality Management

CIVL9855	Water and Wastewater Analysis and Quality Requirements
CIVL9858	Water Quality Management
CIVL9875	Hydrological Processes
CIVL9884	Environmental Engineering Science
CIVL9891	Groundwater Contamination and Remediation

Water Engineering
In addition to the focused areas listed above, a more general MEngSc program in Water Engineering can be undertaken by choosing seven or more subjects from any of the subjects listed above or from the additional subjects listed below. Subject to the course coordinator's approval, additional subjects may also be taken from other programs offered by the School of Civil Engineering or by another School or Faculty.

Additional Subjects

CIVL9799	Environmental Geomechanics
CIVL9832	Transients in Open Channels and Pipes
CIVL9833	Design of Hydraulic Structures
CIVL9848	Water Resource System Design
CIVL9852	Water Distribution and Sewage Collection
CIVL9861	Remote Sensing in Contaminated Site Assessment
CIVL9862	Fluvial Hydraulics
CIVL9871	Water Supply and Sanitation in Developing Countries
CIVL9880	Groundwater Modelling
CIVL9888	Environmental Management
CIVL9889	Environmental Economics and Law
CIVL9890	Spatial Decision Support Systems in Water Resources
CIVL9909	Project (36 credit points)

8612.6000 Computational Engineering

Core Subjects

ANCE8001	Computational Mathematics
ANCE8002	Supercomputing Techniques
CIVL9909	Project

Elective Subjects
Other subjects to be chosen from those offered by the School of Civil Engineering or as approved by the Head of School.

8614
Master of Engineering Science

MEngSc
(External Mode Delivery)

External MEngSc courses are offered on a fee paying basis. Specialisation is offered in the following areas:

- Waste Management
- Water and Wastewater Treatment
- Groundwater Investigations and Management

Each specialised area has a requirement of five compulsory core subjects with elective subjects to be chosen either from core subjects in alternative specialisation areas listed below or from additional (non-core) subjects listed below.

Subjects offered and details of each specialisation's core requirements are given below:

Specialisation Area Core Subject Requirements

Note: A large number of these subjects are recent initiatives The course coordinator has detailed subject descriptions.

Waste Management

CIVL8851	Unit Operations in Public Health Engineering
CIVL8872	Solid Waste Management
CIVL8881	Hazardous Waste Management
CIVL8884	Environmental Engineering Science 1
CIVL8885	Environmental Engineering Science 2

Water and Wastewater Treatment

CIVL8851	Unit Operations in Public Health Engineering
CIVL8855	Water and Wastewater Analysis and Quality Requirements
CIVL8856	Water Treatment
CIVL8857	Wastewater Treatment and Disposal
CIVL8884	Environmental Engineering Science 1

Groundwater Investigations and Management

CIVL8860	Investigation of Groundwater Resources
CIVL8861	Environmental and Engineering Geophysics
CIVL8875	Hydrological Processes
CIVL8884	Environmental Engineering Science 1
CIVL8891	Groundwater Contamination and Remediation

Additional Subjects

CIVL8799	Environmental Geomechanics
CIVL8860	Investigation of Groundwater Resources
CIVL8861	Environmental and Engineering Geophysics
CIVL8889	Environmental Economics and Law
CIVL8909	Project (36 credit points

8615
Master of Environmental Engineering Science

MEnvEngSc
(Internal Mode Delivery)

Core Subjects

CIVL9884	Environmental Engineering Science 1
CIVL9885	Environmental Engineering Science 2
CIVL9888	Environmental Management
CIVL9889	Environmental Economics and Law

Elective Subjects
Three elective subjects are chosen from those offered by the School of Civil Engineering or other subjects approved by the course coordinator. The three elective subjects and project (or six subjects if project not taken) should be in a particular program area and should be selected in consultation with the course coordinator.

8617
Master of Engineering Science
MEngSc
(External Mode Delivery)
Engineering Construction and Management

External MEngSc courses are offered on a fee paying basis. Specialisation is offered in the following areas:

- Engineering construction and management
- Project management
- Construction management
- Technology management

Subject to approval a program is selected from the following subjects:

Management

CIVL8701	Financial Management
CIVL8702	Time Managementl
CIVL8703	Quality and Quality Systems
CIVL8706	Human Resources Management
CIVL8707	Contracts Management
CIVL8710	Management of Risk
CIVL8714	Resource Management
CIVL8725	Engineering Financial Management
CIVL8726	Legal Studies and Professional Practice
CIVL8731	Project Management Framework

Construction

CIVL8723	Construction Design
CIVL8724	Construction Engineering and Technology
CIVL8727	Construction Estimating and Tendering
CIVL8728	Special Topic in Construction

Project/Thesis

CIVL8909	Project (36 credit points)

8618
Master of Environmental Engineering Science
MEnvEngSc
(External Mode Delivery)

Note: This is a new course. The course coordinator has detailed subject descriptions.

Core subjects

CIVL8884	Environmental Engineering Science 1
CIVL8885	Environmental Engineering Science 2
CIVL8888	Environmental Management
CIVL8889	Environmental Economics and Law

Elective subjects

CIVL8799	Environmental Geomechanics
CIVL8851	Unit Operations in Public Health Engineering
CIVL8855	Water and Wastewater Analysis and Quality Requirement
CIVL8856	Water Treatment
CIVL8857	Wastewater Treatment and Disposal
CIVL8860	Investigation of Groundwater Resources
CIVL8861	Environmental and Engineering Geophysics
CIVL8872	Solid Waste Management
CIVL8875	Hydrological Processes
CIVL8881	Hazardous Waste Management
CIVL8891	Groundwater Contamination and Remediation
CIVL8909	Project (36 credit points)

Graduate Diplomas in Civil Engineering

Graduate Diploma students undertake 96 credit points of coursework. Candidates may choose from a range of subjects in the special area of their choice. All subjects offered in the Masters programs can also be taken in the Graduate Diploma programs subject to the approval of the course coordinator. There are also opportunities to select subjects from other professional areas in which candidates may be interested. In some cases 48 credit points may be derived from approved undergraduate subjects and the programs may contain subjects from other schools of the Faculty, other faculties of the University and other universities to the approval of the course coordinator.

It should be noted that some candidates who have partially or fully completed the requirement but not taken out the diploma may considered for upgrading to the MEngSc program with advanced standing.

External GradDip courses are offered on a fee paying basis

5459
Graduate Diploma

GradDip
(Internal Mode Delivery
Civil Engineering

Subjects offered are the same as those for **8612** (see above).

5454
GradDip
(External Mode Delivery)
Engineering Construction and Management

Subjects offered are the same as those for **8617** (see above). Specialisation is offered in the following areas:

- Engineering construction and management
- Project management
- Construction management
- Technology Management

5498
GradDip
(External Mode Delivery)

Specialisation is offered in the following areas:

- Waste Management
- Water and Wastewater Treatment
- Groundwater Investigations and Management

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organisational 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
CP7.5 S1 L1 T2
Note/s: This is a servicing subject for courses offered by other schools and faculties. This subject is not offered every year.

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

CIVL0636
Properties of Materials
Staff Contact: Dr N. Gowripalan
CP5 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: A/Prof R.J. Cox
CP10 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: Prof S. Valliappan
CP7.5 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.

CIVL1011
Civil Engineering Practice 1
Staff contact: Dr S.J. Foster
CP15 S1 L1 T1 S2 L2 T2

Introduction to the structure, nature and scope of civil engineering. Topics include: history of engineering; civil engineering today; organisation of the profession; the engineer in society; environmental, social and legal considerations; introduction to engineering design and management principles; concepts of engineering projects; initiation, feasibility, environmental impact; typical project life cycles; civil engineering failures and engineering responsibilities; communication methods and skills; oral presentations; report writing, presentation and expectations; case studies of major civil engineering projects.

CIVL1015
Computing
Staff contact: School Office
CP10 S1 or S2 L1 T3
Corequisite: MATH1131 or MATH1141

A subject designed to introduce students to computers and computing and encourage students to use the computer as a tool throughout their undergraduate course and their subsequent careers. Topics include: introduction to PC's; computer management and computer systems; word processing; spreadsheets; data/report presentation; spatial visualization; computer aided drafting; Pascal programming.

CIVL1312
Statics
Staff contact: Prof R.I. Gilbert
CP7.5 S1 L1.5 T1.5
Corequisite: MATH1131 or MATH1141

An introductory subject in engineering mechanics dealing with conditions of equilibrium in civil engineering structures and fluids. Topics include: two dimensional concurrent and non-concurrent force systems; resultant of forces; equilibrium of forces; distributed forces; centre of gravity; centroids; internal actions; analysis of beams (shear force and bending moment diagrams); analysis of frames (determinancy, internal hinges); analysis of trusses (methods of joints and sections); fluid statics; analysis of cables; introduction to three dimensional statics.

CIVL1313
Dynamics
Staff contact: Dr R.E. Lawther
CP5 S2 L1 T1
Corequisite: CIVL1312, PHYS1979, MATH 1131 or MATH 1141

An introductory subject dealing with the mechanics of bodies in motion. Topics include; dynamics of particles; laws governing conservation of energy and 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 and environmental engineering problems.

CIVL1314
Mechanics of Solids
Staff contact: Dr M.M. Attard
CP7.5 S2 L2 T1
Prerequisite: CIVL1312
Corequisite: MATH1131 or MATH1141

An introduction to the mechanics of solids. Topics include: properties of cross-sectional shapes; concepts of stress and strain; stress versus strain relationships (linear and non-linear); bars subjected to axial force, stress, strain, elongation and strain energy; homogeneous and non-homogeneous bars; compatibility conditions; bars in bending, stresses, strains and curvature; deflections due to bending, double integration, step functions and virtual work; indeterminate beams; bars in shear and torsion; shear flow in open and closed cross-sections; shear strain and deformation; stresses and strain at a point; Mohr's circle; principle stresses.

CIVL1710
Environmental Engineering Practice 1
Staff contact: Mr G.R. Mostyn
CP15 F L1 T2

This subject introduces students to environmental engineering and its place in society, integrates the various parts of the environmental engineering degree program and seeks to develop students' skill in critical thinking, communication, teamwork and research. Topics covered in formal lectures include: brief history of engineering; role of engineers in society; concept of engineering projects; what is the environment; problem definition; decision making with respect to the environment; public participation including the role of sustainability and influence of engineering practice; environmentalism and paradigms; analysing current environmental issues; the engineer and the law; ethics; communication methods and skills; oral and written presentations.

CIVL2011
Civil Engineering Practice 2
Staff Contact: School Office
CP20 F L2 T2
Prerequisites: CIVL1011, MATH1231 or MATH1241
Corequisite: MATH2869

An integrating subject introducing students to the multi-disciplinary nature of real world engineering problems and the relationship of engineering to the wider socio-economic environment. Case studies in formulation, modelling and resolution of engineering problems including geotechnical, transportation, environmental, water, structural, construction and related issues. An holistic approach to addressing complex engineering problems, engineering methodology, community participation and public involvement, sustainability, equity and distributional effects. Basic systems concepts applied to Civil Engineering. Classification and representation of systems, dynamic behaviour. The systems approach to planning and design. Evaluation and selection procedures. Modelling concepts in relation to engineering problems. Problem definition and formulation. Illustration with case studies. The use of models for numerical analysis and decision making; Techniques of systems analysis including simulation, optimisation, network models, economic models and decision theory. Computer applications. Variability and uncertainty. Use of probabilistic and statistical information.

CIVL2116
Engineering Construction
Staff Contact: School Office
CP10 F L1 T1
Prerequisite: CIVL1011
Corequisite: CIVL2011

An introduction to the design and planning of construction operations, the selection of plant and equipment and researching issues associated with construction. Topics include : Earthmoving; temporary works including scaffolding, formwork, dewatering systems; specialist techniques including drilling, compressed air systems, explosives and blasting, ground anchors, grouting methods and work physiology; aggregate production including quarrying, dredging, recycled materials; building construction including foundations, piles, cranes, steel construction, concrete construction and masonry construction; plus a selection of particular construction activities including dam construction, coffer dams and caissons, tunnelling, pipelines and road, railway and bridge construction.

CIVL2312
Introduction to Structures
Staff Contact: School Office
CP5 S1 L1.5 T0.5
Prerequisite: CIVL1314

An introductory subject in the field of structural design. Topics include : Concepts of limit states design (design objectives; strength, serviceability and durability limit states); types of structures (revision of statics); loads on structures (dead, live, wind and earthquake loads); design of tension and stocky compression members; failure theorems; laterally supported steel beams and simple connections; simple columns (Euler buckling, stability, slenderness).

CIVL2313
Structural Analysis 1
Staff Contact: School Office
CP7.5 S2 L2 T1
Prerequisite: CIVL1314

The principles and requirements of structural analysis of indeterminate trusses and frames. Topics include: structural idealization; determinacy; principle of virtual work, the force method (flexibility analysis); reciprocal theorems; force and displacement transformations; contragredience.

CIVL2314
Engineering Materials
Staff Contact: School Office
CP12.5 F L1.5 T0.5 (S1) L2 T1 (S2)
Prerequisite: CIVL1314

An introduction to the properties and behaviour of civil engineering materials including concrete, steel, other metals, polymers and timber. Topics include : Concrete Technology : composition, constituents and properties of fresh and hardened concrete; mix design; quality control; long term effects; durability. Metals Technology : origins of the strength of steel; stress-strain relationships; elastic and plastic behaviour; phase constitution and microstructure of steels; heat treatment; standard grades of steel; overload and progressive fracture; creep; fatigue; fracture mechanics and damage tolerant design; non-ferrous alloys; welding of steels; corrosion of steel; Timber and Polymers: structure, properties and applications.

CIVL2321
Engineering Mechanics & Materials
Staff Contact: School Office
CP15 F3
*Prerequisites:*CIVL1312

Mechanics of solids: statics, properties of sections, axial force, bending, shear, principal stresses, torsion, combined stresses, principal strains. Materials: cements, aggregates, admixtures, properties of concrete, corrosion, mix design, quality control, testing, metals, response to loading, creep, fatigue, polymers and ceramics.

CIVL2515
Water Engineering 1
Staff Contact: School Office
CP7.5 S2 L2 T1
Prerequisites: CIVL1312, MATH1131 or MATH1141
Corequisites: CIVL1313, MATH2869

An introductory subject in water engineering dealing with the hydrological cycle and its components and basic concepts in hydrology and hydraulics. Topics include: Rainfall generation, properties of fluids, the continuity principle, energy and its global circulation, Bernoulli's theory, momentum flux and force balances, energy losses, flow in pipes, infiltration.

CIVL2710
Environmental Engineering Practice 2
Staff Contact: School Office
CP20 F4
Prerequisites: CHEM1002, CIVL1015, CIVL1710, MATH1231 or MATH1241
Corequisite: MATH2869

This subject follows Environmental Engineering Practice 1 and further develops the students' understanding of environmental engineering and its place in society, it continues to integrate the various parts of the environmental engineering degree program and seeks to further develop the students' skill in critical thinking, communication, teamwork and research. Topics covered in formal lectures include: Formal systems concepts and practice; dealing with complexity; the broad framework of the physical environment in which we live; sources of information on natural and social systems; introduction to EIS; risk - quantification, management, perception and communication; ecological risk assessment; the media; current environmental issues; accounting for the environment; applied data analysis.

CIVL3007
Environmental Fluid Mechanics
Staff Contact: Dr D.A.Luketina
CP15 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. Unsteady flow in pipes. Sediment transport.

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.

CIVL3011
Civil Engineering Practice 3
Staff Contact: School Office
CP20 F L1 T3
Prerequisite: CIVL2011
Corequisites: CIVL3116, CIVL3214, CIVL3313, CIVL3418, CIVL3517

A project based subject integrating the material learnt in the various subdisciplines of civil engineering. Four major projects are completed, two in each semester. Each project is multi-disciplinary and will involve the identification of major issues and the development of solutions for open-ended problems including considerations of the environment, economic and social impact of the proposed solutions. This subject is focal in Year 3 of the undergraduate civil engineering program reinforcing the material covered in the subjects being undertaken concurrently.

CIVL3015
Engineering Computations
Staff Contact: School Office
CP10 F L1 T1
Prerequisites: CIVL1015, MATH2016

Topics include: Solution of linear and non-linear equations; curve fitting and interpolation (least squares); numerical integration; finite differences; differential equations, boundary value problems, initial value problems; eigenvalue problems; partial differential equations (civil and environmental engineering applications); time series (Fourier transfers); finite elements; introduction to appropriate computer software.

CIVL3017
Management for Environmental Engineers 1
Staff Contact: Dr P.R. Gibson
CP10 F 1.5 T.5
Prerequisites: CIVL1007, CIVL2106

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

CIVL3106
Engineering Computations
Staff Contact: Dr I.J. Somervaille
CP10 F L1 T1
Prerequisites: CIVL1106, MATH2009

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

CIVL3116
Engineering Management 1
Staff Contact: School Office
CP10 F L1 T1
Prerequisite: CIVL2011

Basic techniques used in the management of projects and engineering works; purpose and principles of management; management of people, plant, materials, money and sites; planning and control, the critical path method; management of quality and risk; theory of the management of humans and organization; use and management of information systems.

CIVL3203
Structural Analysis
Staff Contact: Dr R.E. Lawther
CP15 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.

CIVL3214
Geotechnical Engineering 1
Staff Contact: School Office
CP15 F L2 T1
Prerequisites: CIVL1314, MATH2019
Corequisite: CIVL3011

An introductory subject to fundamental and applied soil mechanics and geological engineering. Topics include: Fundamental Soil Mechanics : 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; 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; Applied Soil Mechanics : basics of foundation, design, types and their application; site investigation and selection of design parameters; Geological Engineering : the earth and its formation, rock classification, formation; properties of sedimentary, metamorphic and igneous rocks; sediments, including alluvial, colluvial, wind deposited, chemical; rock defects and their engineering significance; rock weathering classification and its effect on properties.

CIVL3303
Structural Design
Staff Contact: Dr S.J. Foster
CP20 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.

CIVL3312
Structural Engineering 1
Staff Contact: School Office
CP12.5 S1 L4 T1
Prerequisites: CIVL2312, CIVL2313
Corequisite: CIVL3011

A subject consisting of structural design and structural analysis strands. In the design strand, topics include: Revision of limit states; material types and properties; historical view of reinforced concrete; durability requirements; behaviour of cross-sections in bending; service and ultimate loads; ultimate strength analysis and design of cross-sections in both flexure (singly and doubly reinforced, ductility) and in shear; serviceability analysis and design of beams (cracked section analysis, deflection and crack control); bond anchorage and curtailment (simple and continuous beams and one-way slabs). In the analysis strand, topics include: applications of the stiffness method of analysis; moment distribution applied to continuous beams and non-sway frames; plastic analysis; elastic stability analysis; and an introduction to structural analysis computer packages.

CIVL3313
Structural Engineering 2
Staff Contact: School Office
CP12.5 S2 L4 T1
Prerequisite: CIVL3312
Corequisite: CIVL3011

The design of reinforced concrete, prestressed concrete and steel structural members. Topics include: Reinforced Concrete : Design of beams and beam-columns (including slenderness effects); slab systems including edge-supported slabs, flat slabs and flat plates; punching shear considerations; design of footings including strip, pad and raft footings, combined and tie-back footings. Prestressed Concrete : Basic concepts and materials; design of beams and one-way slabs for strength and serviceability. Structural Steel : Limit states requirements; design of steel beams including considerations of local buckling, lateral buckling and web buckling; bolted and welded connections; behaviour and design of steel columns and beam-columns; slenderness effects in frames.

CIVL3402
Geotechnical Engineering 1
Staff Contact: Dr N. Khalili
CP15 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.

CIVL3418
Transport Engineering 1
Staff Contact: School Office
CP5 S2 L1 T1
Prerequisites: CIVL2011, MATH2019

This subject is expected to develop integrated planning skills in Land-use transport and the environment. Topics include: Definitions, properties and measurements over space and time of traffic flow; traffic concentration and traffic speed; time and space headways; definitions and concepts related to land use and transport systems; equation of state; traffic generation; trip distribution; traffic assignment and mode choice; computer modelling of transport systems; environmental considerations such as noise, emissions and energy consumption; assessment of environmental and community impacts.

CIVL3428
Transport & Noise Engineering
Staff Contact: School Office
CP7.5 F S1 1 S2 2
Prerequisites: CIVL2710, MATH2019, MATH2869

There are two separate, independent component of this subject - Noise Engineering and Transport Engineering. The first deals with environmental acoustics and commences by considering the basic technology. From there both the analytical techniques and procedures involved in noise impact assessment and control are covered. The second component is concerned with analysis of traffic and transport systems. In particular it focuses on the interactions between transportation, land use and the environment.

CIVL3505
Hydraulics 2
Staff Contact: Dr D.A. Luketina
CP15 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. Hydraulic models: dimensional analysis, similarity criteria and scale selection, scale effects.

CIVL3517
Water Engineering 2
Staff Contact: School Office
CP15 F L2 T1
Prerequisites: CIVL2512, MATH2019
Corequisites: CIVL3011, MATH2869

A subject which builds on the basic concepts introduced in Water Engineering 1. Topics include: Determinism and stochasticity of models; open channel flow; rainfall estimation for design; flood estimation; groundwater analysis; boundary layers for fluid flow; water quality parameters; unit operations in treatment of water bodies; water and wastewater treatment processes.

CIVL3521
Principles and Applications of Aquatic Chemistry
Staff Contact: School Office
CP7.5 S2 3
Prerequisites: CHEM1002,MATH2009
Corequisite: CIVL3517

The basic concepts of equilibrium chemistry and kinetics are extended in this course to enable analysis of complex aqueous systems typical of surface water, groundwater and marine environments. The principles of acid-base behaviour, solid dissolution and precipitation, complexation, oxidation and reduction and interactions at solid surfaces are presented such that problems pertaining to natural system behaviour, water quality degradation and water and wastewater treatment can be coherently addressed. A problem solving approach is emphasised.

CIVL3601
Engineering Management 1
Staff Contact: Dr R.R. Wakefield
CP10 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: critical path method. Operations research in management: methodologies for problem solving. Theory of the management of humans. Theory of the management of organisations. Use and management of information systems.

CIVL3705
Water Resources
Staff Contact: Dr J.E. Ball
CP15 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, optimization.

CIVL3710
Environmental Engineering Practice 3
Staff Contact: School Office
CP20 F4
Prerequisites: CIVL2515, CIVL2710, INDC4120

This subject follows Environmental Engineering Practice 2 and further develops the students, understanding of environmental engineering and its place in society. It continues to integrate the various parts of the environmental engineering degree program and seeks to further develop the students' skill in critical thinking, communication, teamwork and research. Formal lectures will be used to provide introduction to the project work, continue presentations on current environmental issues and on communication techniques. Students will be expected to undertake surveys and attend public meetings.

CIVL3804
Transport Engineering
Staff Contact: Dr M.C. Dunne
CP10 F L1 T1
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.

CIVL4006
Industrial Training
Staff Contact: Mr G. Nawar
CP0

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

CIVL4007
Waste Management
Staff Contact: Mr S.J. Moore
CP7.5 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.

CIVL4008
Industrial Training - Civil
Staff Contact: School Office
CP0

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 in Year 4, and to present a seminar during Session 1 of Year 4 outlining their industrial training experiences.

CIVL4011
Civil Engineering Practice 4
Staff Contact: School Office
CP20 L1 T3
Prerequisite: CIVL3011
Corequisites: CIVL4214, CIVL4312, CIVL4413, CIVL4515

Similar in format to CIVL 3011, this final year integrating subject involves formulating designs for and solution to real world civil engineering problems. The problems will be drawn from industry and will be multi-disciplinary involving application of material learnt throughout the undergraduate program. Four final year projects will be undertaken and will involve the preparation of working drawings and project reports similar to those required in industry.

CIVL4017
Water Engineering (Major)
Staff Contact: Dr J.E. Ball
CP15 S2 L4 T2
Prerequisites: CIVL3705, CIVL3007, CIVL4605

Specialisation in four of the following topics: Water Resources, Hydrology, Hydraulics, Coastal Engineering, Water Quality, Groundwater, Water and Wastewater Treatment. Environmental and Social Issues.

CIVL4018
Honours Thesis
Staff Contact: School Office
CP15 F3
Prerequisites: All third year
Corequisite: The appropriate major

Only students averaging greater than 60% in all subjects in Years 1, 2 and 3 will be permitted to undertake the honours thesis. The thesis may describe directed laboratory, investigatory, design, field or research work on an approved subject and will be completed under the guidance of a member of the academic staff. This subject must be satisfactorily completed by all students wishing to obtain an honours degree.

CIVL4027
Geotechnical Engineering (Major)
Staff Contact: Mr G.R.Mostyn
CP15 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, residential 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.

Environmental Geomechanics: Clay mineralogy, reactive soils, dispersive soils, investigation of contaminated sites, geotechnical design of landfills, contaminant migration in soil, site remediation.

CIVL4037
Environmental Values
Staff Contact: Mr G. R. Mostyn
CP15 S1 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 (Major)
Staff Contact: Dr S.E.Samuels
CP15 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 each). 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: Dr P. R. Gibson
CP5 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, basic accounting techniques, preparation and interpretation of financial statements. Local and international funding of engineering projects.

CIVL4067
Legislative Aspects of the Environment
Staff contact: Mr G.R. Mostyn
CP7.5 S1 L2 T1
Prerequisite: CIVL1007

Commonwealth and State laws relating to environment protection, environmental planning, pollution control, waste management, hazardous and intractable substances, natural resources and heritage. The concepts of regional and local environment plans. Development application procedures. Environmental impact statements (EIS) and environmental impact assessment (EIA). Scoping. The public inquiry and mediation processes. Evolution of public policy. The influence of the conservation movement. Government agencies and their respective responsibilities. Commonwealth-State Ministerial Councils.

CIVL4077
Professional Practice
Staff contact: Mr G.R. Mostyn
CP7.5 S2 L1 T2
Prerequisites: CIVL4007, CIVL4057
Corequisites: CIVL4907 and two majors

This subject is seminar, tutorial and problem based and is intended to provide a background on topics not covered in other parts of the BE (Environmental) degree course. Topics will be selected from: environmental economics; professional practice; ethics; occupational health and safety for contaminated sites; risk assessment; environmental management audits; and additional topics developed in consultation with the students. In addition, the subject will provide some integration of the overall content of the course and will further develop the students' skill in critical thinking, communication, teamwork and research.

CIVL4101
Engineering Management 2
Staff Contact: Mr J.B. O'Brien
S1 L1.5 T.5
Prerequisite: CIVL3601

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

CIVL4116
Engineering Management 2
Staff Contact: School Office
CP5 S1 L1 T1
Prerequisites: CIVL3011, CIVL3116

An introduction to contracts management and administration; legal matters and professional practice; business and financial management, accounting; management of international projects;

CIVL4119
Construction Major
Staff Contact: School Office
CP20 S2 L6 T2
Prerequisites: CIVL4116 and all third year subjects.

Professional level construction 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.

CIVL4203
Structural Engineering
Staff Contact: Dr F. Barzegar
CP10 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.

CIVL4214
Geotechnical Engineering 2
Staff Contact: School Office
CP7.5 S1 L2 T1
Prerequisite: CIVL3214

Theoretical presumptive bearing capacity of shallow foundations. Allowable settlement and foundations on sand, clay and rock. Lateral earth pressures and retaining

wall design. Single axially and laterally loaded piles, pile groups. Stability of slopes, infinite slopes, two wedge, method of slices.

CIVL4219
Geotechnical Major
Staff Contact: School Office
CP20 S2 L6 T2
Prerequisites: CIVL4214, CIVL4413

Advanced pavement engineering including pavement maintenance and management, rock engineering, slopes and tunnels; foundation engineering; finite element analysis, critical state theory and liquefaction; soil engineering including site investigations, in-situ testing, laboratory testing, investigation of contaminated sites. Field trip of 21/2 days duration.

CIVL4229
Geotechnical Major - Environmental
Staff Contact: School Office
CP15 S2 6
Prerequisites: All third year subjects
Co-requisites: CIVL4710

Environmental geomechanics - selected topics from clay mineralogy, dispersive soils, investigations for contaminated sites, landfill design, contaminant migration, remediation of contaminated sites. Foundation engineering - shallow foundations, bearing capacity, foundations on sand, rock and reactive soils, retaining walls, pile capacity and settlement under axial and lateral loads, analysis of the stability of slopes. Soil engineering - the influence of geology and geotechnical behaviour of soil and rock, site investigation techniques, in-situ testing, laboratory testing and potential errors.

CIVL4306
Engineering and the Environment
Staff Contact: Mr G.R. Mostyn
CP10 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.

CIVL4312
Structural Engineering 3
Staff Contact: School Office
CP7.5 S1 L2 T1
Prerequisite: CIVL3313
Corequisite: CIVL4011

The final undergraduate core subject in the field of structures. Topics include : Concrete Structures : detailing of elements and connections; retaining walls and footings; continuous prestressed beams and slabs; design of anchorage zones and transfer strength; Composite Structures : floor systems; slabs and girders; bridges; Timber Engineering : materials; design of simple elements; domestic construction.

CIVL4319
Structures Major
Staff Contact: School Office
CP20 S2 L6 T2
Prerequisite: CIVL4312

This subject is for students wishing to specialise in structural engineering. Advanced topics will be presented in the broad fields of bridge engineering, concrete structures, concrete technology, steel structures, structural analysis and structural dynamics.

CIVL4403
Materials Engineering 2
Staff Contact: Dr A.C. Heaney
CP7.5 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.

CIVL4413
Transport Engineering 2
Staff Contact: School Office
CP7.5 L2 T1
Prerequisites: CIVL3214, CIVL3313, CIVL3418

This subject is expected to develop skills related to highway design and pavement evaluation. Topics include: Introduction to road design including elements, history, terminology and driver influence; route location process; design practice of urban and rural roads, intersections and interchanges; computer aided design; road traffic loadings; subgrade evaluation; base and sub-base materials; surfacings; design of flexible pavements and rigid pavements.

CIVL4419
Transport Major
Staff Contact: School Office
CP20 S2 L6 T2
Prerequisites: CIVL3418, CIVL4413

An advanced course covering a wide variety of transport engineering topics. Topics include: Analytical and computer aided methods for geometric design of roads; design for traffic management and control; efficiency; safety; environment factors; information systems; lighting; environmental and social impact of transport design; transport system design and operations; These topics are covered in four strands: (1) Road design; (2) Environmental

Impact of Transport; (3) Traffic Management and Control, and (4) Transport Operations.

CIVL4429
Transport Major - Environmental
Staff Contact: School Office
CP15 S2 6
Prerequisites:: All third year subjects
Corequisite: CIVL4710

Emphasis is placed on the design aspects of transport systems - road design, design for traffic management and control, design for transport operations and the environmental impacts of transport. All transport modes are covered but there is a bias towards road transport because of the prominence of this mode in professional practice. Students take three strands, the first two - Road design and Environmental Impact of Transport - are compulsory. In addition, either Design for traffic management and control or Transport operations are also taken. Finally the Transport Major includes several field trips and half day workshop organised in conjunction with IEAust.

CIVL4502
Geotechnical Engineering 2
Staff Contact: Dr G. Swarbrick
CP7.5 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.

CIVL4515
Water Engineering 3
Staff Contact: School Office
CP7.5 S1 L2 T1
Prerequisite: CIVL3517
Corequisite: MATH2019

A subject which continues the introduction of topics associated with the practice of water engineering. Topics include: Analysis of pumps; estimation of sediment transport; municipal engineering including potable water distribution systems, sanitary sewer collection systems, stormwater systems; water management and economics; introduction to unsteady flow systems.

CIVL4519
Water Major
Staff Contact: School Office
CP20 S2 L6 T2
Prerequisite: CIVL4515

A subject to enable those students interested in water engineering to specialise in that area. Topics will be selected from three areas which are Coastal Engineering and Hydraulics, Water Resources, Hydrology and Groundwater, and Environmental Water and Public Health.

CIVL4522
Environmental Water Engineering
Staff Contact: School Office
CP12.5 F S1 3 S2 2
Prerequisites: CIVL3517, CIVL3521

There are four strands to this subject. These being water engineering, environmental fluid mechanics, water treatment and wastewater treatment. Water engineering covers pumps, sediment transport, municipal applications such as sewer design, and water management. Environmental fluid mechanics is focused on spreading of substances in the air and water environments. Water treatment covers how drinking water properties can be corrected by physical, chemical and microbiological treatment. Wastewater treatment examines the required level of treatment of wastewater and the fundamental microbiology of wastewater treatment. Tradeoffs between degrees of treatment and risk are an important component of both water treatment and wastewater treatment in addition to management and operation issues.

CIVL4523
Transport and Fate of Pollutants in Coastal and Groundwater Environments
Staff Contact: School Office
CP7.5 S1 3
Prerequisite: CIVL3521
Corequisite:CIVL4522

This subject builds on and integrates material covered in CIVL3521 and CIVL4522. There are two basic strands: coastal environments and groundwater environments. The coastal environments strand covers the nearshore zone, lagoons, estuaries/rivers and outfalls. The groundwater environments strand focuses on quantification of the groundwater resource, its sustainability and contamination of that resource.

CIVL4529
Water Major - Environmental
Staff Contact: School Office
CP15 S2 6
Prerequisites: All third year subjects
Corequisites: CIVL4523, CIVL4710

A subject to enable those students interested in water engineering to specialise in that area. Topics will be selected from areas which include: coastal engineering, hydraulics, water resources, hydrology, groundwater, environmental water, and public health.

CIVL4605
Water Supply and Wastewater Disposal
Staff Contact: Mr P.J.Bliss
CP7.5 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. Water reuse.

CIVL4704
Highway and Pavement Engineering
Staff Contact: A/Prof B. Shackel
CP7.5 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 lighting.

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.

CIVL4710
Environmental Engineering Practice 4
Staff Contact: School Office
CP20 F 4
Prerequisite: CIVL3710
Corequisites: CIVL4522, CIVL4720, CIVL4730, CEIC0040

This subject follows Environmental Engineering Practice 3 and further develops the students, understanding of environmental engineering and its place in society. It continues to integrate the various parts of the environmental engineering degree program and seeks to further develop the students, skill in critical thinking, communication, teamwork and research. Formal lectures will be used to provide introduction to the project work, continue presentations on current environmental issues and on communication techniques.

CIVL4717
Industrial Training - Environmental
Staff Contact: School Office
CP0
Prerequisite: CIVL3710
Corequisite: CIVL4710

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, and to present a seminar outlining their industrial training experience.

CIVL4718
Honours Thesis
Staff Contact: School Office
CP15 F 3
Prerequisites: All third year subjects
Corequisites: CIVL4710 and appropriate major

Directed laboratory, investigatory, field or research work on an approved subject under the supervision of academic staff. Each student is required to present a seminar and written thesis on the work undertaken. Students must satisfactorily complete this subject to be considered for the award of an honours degree.

CIVL4720
Waste Management and Site Remediation
Staff Contact: School Office
CP7.5 S1 3
Prerequisite: CIVL3214
Corequisite: CEIC0040

The subject provides an introduction to waste management and remediation of contaminated sites. It covers a range of management and remediation techniques involving waste characterisation, waste minimisation, landfill design and management, environmental site investigation and auditing, technology screening and remediation design.

CIVL4730
Environmental Management
Staff Contact: School Office
CP10 S1 4
Prerequisite: CIVL3710

This subject provides an introduction to management of human impact on the environment through law, environmental impact assessment, policy and use of economic tools. It considers a range of management techniques involving economic tools, 'self regulation' using continuous improvement against prescribed environmental targets and management plans, and a range of other innovations in combination with legislation, to achieve environmental management goals. The relative responsibilities of local, state and federal government in Australia, and the role of international agreements and conventions, are also discussed to provide the context of environmental management.

CIVL4811
Construction Major
Staff Contact: Mr J.B. O'Brien
CP22.5 S2 L6 T3
Prerequisites: CIVL2301, CIVL4101, CIVL4306 and all Year 3 subjects

Professional level construction and project management skills and techniques: advanced construction technology topics and topics in the planning, design, organisation, 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.

CIVL4822
Geotechnical Major
Staff Contact: Mr G.R. Mostyn
CP22.5 S2 L6 T3
Prerequisites: CIVL4306, CIVL4502, CIVL4704

Advanced pavement engineering. Site investigations for pavements, stabilization, stress analysis in flexible and rigid pavements, asphalt, segmental pavements. Rock engineering of slopes and tunnels. Environmental Geomechanics - clay mineralogy, dispersive soils, contaminant transport and redmediation. Foundation engineering. Soil engineering including site investigation and characterisation, landslides and slope stabilization, 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: Prof R.I. Gilbert
CP22.5 S2 L6 T3
Prerequisites: CIVL4203, CIVL4403

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

CIVL4844
Transport Major
Staff Contact: Dr S.E.Samuels
CP22.5 S2 L6 T3
Prerequisite: CIVL4306, CIVL4704

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

CIVL4855
Water Major
Staff Contact: Dr J.E. Ball
CP22.5 S2 L6 T3
Prerequisites: CIVL3505, CIVL3705, CIVL4605

Specialisation in six of the following strands (only six topics are offered each year): Water resources. Hydrology. Advanced hydraulics. Coastal engineering.Water quality. Water and wastewater treatment. Groundwater. Environmental and social issues.

CIVL4906
Project/Thesis
Staff Contact: Dr U. Vandebona
CP17.5.5 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
CP17.5 S1 1 S2 6
Staff Contact: Dr U. Vandebona
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.

CIVL8701
Financial Management
Staff Contact: Dr R. R. Wakefield
CP12 S1

Project initiation and development, feasibility studies, planning; economics, review of practical decision-making problems and relevant techniques, benefit/cost analysis, methods of economic appraisal; consideration of inflation and taxation in investment decisions; depreciation; management decision processes, decision theory, utility; life-cycle costing, value management; models and techniques to assist the manager, forecasting; optimization; applications; multiple objective planning; project delivery systems; financial planning, accounting.

CIVL8702
Project Time Management
Staff Contact: Dr R. R. Wakefield
CP12 S2

The planning process; time estimating; the link between planning and control; control systems; the critical path method, networks, resource levelling, resource constrained scheduling, network compression, overlapping relationships, applied cpm, cost influences, project control, legal considerations, simulation in networks, stochastic networks, project management, applications.

CIVL8703
Quality and Quality Systems
Staff Contact: Dr P.R. Gibson
CP12 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.

CIVL8706
Human Resources Management
Staff Contact: Mr J. B. O'Brien
CP12 S2

The development of skills for the management of people and their workplaces; industrial relations, health and safety issues, the recognition of people as the basic unit of engineering productivity and engineering organisations; negotiating theory and practices; the structure and function of organisations, management of group action; work delegation across organisational boundaries; interpersonal skills, conflict management; learning curves; motivation.

CIVL8707
Contracts Management
Staff Contact: Prof D. G. Carmichael
CP12 S1

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

CIVL8710
Management of Risk
Staff Contact: Mr G. Nawar
CP12 S2

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.

CIVL8714
Resource Management
Staff Contact: Prof D.G. Carmichael
CP12 S1

The management of non human (inert) resources such as equipment, plant, materials infrastructure and assets, including maintenance management, asset management, fleet management and related topics; resource acquisition, maintenance and repair policies; procurement, inventory, supply management and control; optimization applications; resource planning; resource disposal.

CIVL8717
Marketing in Technology and Engineering
Staff Contact: School Office
CP12 SS

The interface of technology and engineering with marketing. Marketing of professional consultant services; promotion; advertising; pricing of services. Client management; briefs. Marketing for contractors; competition, competitive bidding; tendering and proposals. Winning and securing work and commissions. Entrepreneurship. Marketing research; environment; products; distribution; strategies.

CIVL8718
Strategic Management in Engineering
Staff Contact: School Office
CP12 SS

Strategic management for engineering and technology based organisations. Strategic versus operational planning; approaches to developing strategies. Influence of environment, resources (people, materials, plant/equipment), opportunities, competition. Strategic change, implementation, control. Influence of organisation size and type.

CIVL8720
Systems Methodology
Staff Contact: School Office
CP12 SS

Problem solving, decision making, innovation, creativity, modelling. Systems approach or thinking to tackling problems. A unified approach and solution of managerial and technical problems. A way of looking at, and the development of, multidisciplinary problems.

CIVL8723
Construction Design
Staff Contact: Dr R.R. Wakefield
CP12 SS
Note/s: This subject is not offered every year.

Design theory as applied to construction processes; application to selected areas of the construction industry, 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.

CIVL8724
Construction Engineering and Technology
Staff Contact: Mr J.B. O'Brien
CP12 SS
Note/s: This subject is not offered every year.

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. Case studies.

CIVL8725
Engineering Financial Management
Staff Contact: Prof D.G. Carmichael
CP12 SS
Note/s: This subject is not offered every year.

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

CIVL8726
Legal Studies and Professional Practice
Staff Contact: Prof D.G. Carmichael
CP12 SS
Note/s: This subject is not offered every year.

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.

CIVL8727
Construction Estimating and Tendering
Staff Contact: Prof D.G. Carmichael
CP12 SS
Note/s: This subject is not offered every year.

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

CIVL8728
Special Topic in Construction
Staff Contact: Mr G. Nawar
CP12 SS
Note/s: This subject is not offered every year.

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.

CIVL8731
Project Management Framework
Staff Contact: Mr J.B. O'Brien
CP12 S1

An overview of project management; the nature of technical and non-technical projects; the project life cycle; the project team, organisational and behavioural aspects; the project

manager; the organisation and management of project resources; project success evaluation techniques; project delivery; management information and decision support systems; case studies in project management; management theory and processes; relationship to general management; functions of project management.

CIVL8803
Project (external) GradDip
CP12 SS

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

CIVL8855
Water and Wastewater Analysis and Quality Requirements
Staff Contact: Ms P.A. FitzGerald
CP12 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.

CIVL8856
Water Treatment
Staff Contact: Ms P.A. FitzGerald
CP12 S2

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.

CIVL8857
Wastewater Treatment and Disposal
Staff Contact: Mr P.J. Bliss
CP12 S2

Application of processes and process variations used to improve the quality of wastewaters and of sewage effluent, and the disposal of the effluent. Re-use of effluents where applicable. Sludge treatment and disposal.

CIVL8872
Solid Waste Management
Staff Contact: Mr S.J. Moore
CP12 SS
Note/s: This subject is not offered every year.

Characterisation of municipal solid waste; collection; transfer stations; waste minimization and recycling; waste treatment, including size reduction, composting, incineration, emerging technologies; landfill disposal, including preparation of landfill management plans and operational aspects; introduction to planning of waste management systems.

CIVL8881
Hazardous Waste Management
Staff Contact: Mr S.J. Moore
CP12 SS
Note/s: This subject is not offered every year.

Waste audits and characterisation of hazardous wastes in regions and industries; control of generation and transport of hazardous waste, manifest systems; waste minimisation; on-site treatment methods; integrated off-site treatment facilities; management of residues from treatment facilities; introduction to planning of regional hazardous waste management systems. Characteristics of individual waste types (dioxins, PCBs, pesticides, heavy metal, etc.) and waste management in individual industries (steel, pulp and paper, petro-chemical, food processing, etc.).

CIVL8884
Environmental Engineering Science 1
Staff Contact: Prof T.D. Waite
CP12 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.

CIVL8891
Groundwater Contamination and Remediation
Staff Contact: Dr R. I. Acworth
CP12 S1

Description of types of groundwater contaminants, sources of groundwater contamination, review of transport equations, mass transport in saturated media, advection and dispersion, biological and chemical transformation of groundwater contaminants, multiphase flow, migration of nonaqueous liquids. Groundwater sampling and analysis, monitoring well design and installation, soil-water and soil-gas monitoring. Treatment and prevention of groundwater contamination. Site investigation methods at contaminant sites. Size remediation: source control, pump and treat, soil vapour extraction, bioremediation.

CIVL8909
Project
CP36 SS

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.

CIVL9402
Transport, Environment, Community
Staff Contact: Dr S.E. Samuels
CP24 F
Note/s: This subject is not offered every year.

Effect of transport on public health, environment and communities. Analysis of unwanted effects of transport activity: accidents, noise, pollution, intrusion; causation, measurement, preventative and remedial action. Community reaction to transport activity; government, bureaucracy and public involvement in transport policy and environment impact statements.

CIVL9403
Theory of Land Use Transport Interaction
Staff Contact: Dr S.E. Samuels
CP12 SS
Note/s: This subject is not offered every year.

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
CP12 SS
Note/s: This subject is not offered every year.

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 P.Hidas
CP12 SS
Note/s: This subject is not offered every year.

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
CP12 SS
Note/s: This subject is not offered every year.

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: Dr S.E. Samuels
CP12 S1

Highway systems and organisation. Roles and interaction of public and statutory highway and transportation authorities and research organisations. 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.

CIVL9414
Transport Systems Part 1
Staff Contact: Dr U. Vandebona
CP12 S1

Definition of basic traffic elements, zero flow travel time, capacity, impedance flow relationship. The determination of shortest path, maximum flow, in networks. The topological description of networks. Location theory applications in relation to transport networks. System parameters, performance. Application of network analysis to road, rail and air transport systems.

CIVL9415
Transport Systems Part 2
Staff Contact: Dr U. Vandebona
CP12 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 congestion-related issues using queueing theory. 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
CP30 F
Note/s: This subject is not offered every year.

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: Dr M.C. Dunne
CP30 F
Note/s: This subject is not offered every year.

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.

CIVL9420
Special Topic in Transport Engineering
Staff Contact: Dr S.E. Samuels
CP12 SS
Note/s: This subject is not offered every year.

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

CIVL9701
Economic Decision Making in Engineering
Staff Contact: Dr R. R. Wakefield
CP12 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 economic 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
Project Planning and Control
Staff Contact: Dr R. R. Wakefield
CP12 SS
Note/s: This subject is not offered every year.

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
Quality and Quality Systems
Staff Contact: Dr R. R. Wakefield
CP12 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.

CIVL9706
Human Resources Management
Staff Contact: Mr J. B. O'Brien
CP12 SS
Note/s: This subject is not offered every year.

The development of skills for the management of people and their workplaces; industrial relations, health and safety issues; the recognition of people as the basic unit of engineering productivity and engineering organisations; negotiating theory and practice; the structure and function of organisations, management of group action; work delegation across organisational boundaries; interpersonal skills, conflict management; learning curves; motivation.

CIVL9707
Contracts Management
Staff Contact: Prof D. G. Carmichael
CP12 SS

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

CIVL9710
Engineering Risk Management
Staff Contact: Mr G. Nawar
CP12 SS
Note/s: This subject is not offered every year.

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
Special Topic in Engineering Management
Staff Contact: Prof D.G. Carmichael
CP12 SS
Note/s: This subject is not offered every year.

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.

CIVL9717
Marketing in Technology and Engineering
Staff Contact: School Office
CP12 S1

The interface of technology and engineering with marketing. Marketing of professional consultant services; promotion; advertising; pricing of services. Client management; briefs. Marketing for contractors; competition, competitive bidding; tendering and proposals. Winning and securing work and commissions. Entrepreneurship. Marketing research; environment; products; distribution; strategies.

CIVL9718
Strategic Management in Engineering
Staff Contact: School Office
CP12 S1

Strategic management for engineering and technology based organisations. Strategic versus operational planning; approaches to developing strategies. Influence of environment, resources (people, materials, plant/equipment), opportunities, competition. Strategic change, implementation, control. Influence of organisation size and shape.

CIVL9720
Systems Methodology
Staff Contact: School Office
CP12 S2

Problem solving, decision making, innovation, creativity, modelling. Systems approach or thinking to tackling problems. A unified approach and solution of managerial and technical problems. A way of looking at, at the development of, multidisciplinary problems.

CIVL9723
Construction Design
Staff Contact: Dr R.R. Wakefield
CP12 S2

Design theory as applied to construction processes; application to selected areas of the construction industry, 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
Construction Engineering and Technology
Staff Contact: Mr J.B. O'Brien
CP12 SS
Note/s: This subject is not offered every year.

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. Case studies.

CIVL9725
Engineering Financial Management
Staff Contact: Dr P. R. Gibson
CP12 SS
Note/s: This subject is not offered every year.

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

CIVL9726
Legal Studies and Professional Practice
Staff Contact: Prof D.G. Carmichael
CP12 SS
Note/s: This subject is not offered every year.

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
Construction Estimating and Tendering
Staff Contact: Prof D.G. Carmichael
CP12 S2
Note/s: This subject is not offered every year.

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

CIVL9728
Special Topic in Construction
Staff Contact: Mr G. Nawar
CP12 SS
Note/s: This subject is not offered every year.

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
Project Management Framework
Staff Contact: Mr J.B. O'Brien
CP12 S1

An overview of project management; the nature of technical and non-technical projects; the project life cycle; the project team, organisational and behavioural aspects; the project manager; the organisation and management of project resources; project success evaluation techniques; project delivery; management information and decision support systems; case studies in project management; management theory and processes; relationship to general management; functions of project management.

CIVL9777
Numerical Methods in Geomechanics
Staff Contact: Dr N. Khalili
CP12 SS
Note/s: This subject is not offered every year.

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 B. Shackel
CP12 S1

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
CP12 S2

Types of pavement, selection on basis of cost and performance. Sub-grade conditions, working platforms and use of geofabrics. Soil moisture equilibrium and drainage requirements. Prediction and characterisation of traffic wheel loadings. Role of environmental factors including temperature and moisture. Stress distribution in flexible and rigid pavements. Computer-based and approximated

methods of analysis. Principles of mechanistic design. Comparative evaluation of design criteria and design procedures for flexible and rigid pavements for roads and airfields.

CIVL9785
Pavement Evaluation and Maintenance
Staff Contact: A/Prof B. Shackel
CP12 SS
Note/s: This subject is not offered every year.

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
CP12 S2
Note/s: Short course format in 1997.

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
CP12 SS
Note/s: This subject is not offered every year.

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
CP12 S2
Note/s: Short course format in 1997

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
CP12 S1
Note/s: This subject is not offered every year.

Stress distribution beneath foundations, settlement analysis, design of shallow footings, design of pile foundations, cast in situ piles, foundation on shrink-swell soils, lateral earth pressures, foundations on rock, site investigations.

CIVL9792
Foundation Engineering 2
Staff Contact: Prof S. Valliappan
CP12 S1
Note/s: This subject is not offered every year.

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
CP12 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.

CIVL9799
Environmental Geomechanics
Staff Contact: Dr G.E. Swarbrick
CP12 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
CP12 S1

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
CP12 SS
Note/s: This subject is not offered every year.

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
CP12 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: Dr F Barzegar
CP12 SS
Note/s: This subject is not offered every year.

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

CIVL9806
Prestressed Concrete 1
Staff Contact: Dr M.M. Attard
CP12 S1

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: Dr M.M. Attard
CP12 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
CP12 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: Dr S.J. Foster
CP12 SS
Note/s: This subject is not offered every year.

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
CP12 SS
Note/s: This subject is not offered every year.

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: A/Prof F.S.K. Tin Loi
CP12 SS
Note/s: This subject is not offered every year.

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
CP12 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. Platee web girders and box girders

CIVL9819
Bridge Design 2
Staff Contact: A/Prof F.S.K. Tin Loi
CP12 SS
Note/s: This subject is not offered every year.

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: A/Prof P.W.Keen
CP12 S2

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: Dr F. Barzegar
CP12 SS
Note/s: This subject is not offered every year.

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
CP12 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
CP12 S2

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.

CIVL9824
Advanced Concrete Technology
Staff Contact: Dr N. Gowripalan
CP12 SS
Note/s: This subject is not offered every year.

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.

CIVL9832
Transients in Open Channels and Pipes
Staff Contact: Dr J.E. Ball
CP12 S1

Analysis of unsteady flows in open channels and closed conduits. Includes development of the appropriate equation set, conversion of coordinate systems into the fundamental characteristic coordinates, flow of information along the characteristic paths. Practical problems associated with unsteady flows are also addressed; these include pump operation, valve operation, the formation of surges and bores, the influence of junctions of channels and conduits on surge propagation.

CIVL9833
Design of Hydraulic Structures
Staff Contact: A/Prof R.J. Cox
CP12 SS
Note/s: This subject is not offered every year.

Theory of waterflow in open channels. Application of theory to design of hydraulic structures, spillways, energy dissipators, channel transitions, gross pollutant traps, side discharge weirs, oil pollution booms.

CIVL9835
Coastal Engineering 1
Staff Contact: A/Prof R.J. Cox
CP12 SS
Note/s: This subject is not offered every year.

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

CIVL9836
Coastal Engineering 2
Staff Contact: A/Prof R.J. Cox
CP12 SS
Note/s: This subject is not offered every year.

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

CIVL9847
Water Resources Policy
Staff Contact: Dr A. Sharma
CP12 SS
Note/s: This subject is not offered every year.

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: Dr A. Sharma
CP12 S2

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.

CIVL9851
Unit Operations in Public Health Engineering
Staff Contact: Mr P.J. Bliss
CP12 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
CP12 SS
Note/s: This subject is not offered every year.

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

CIVL9855
Water and Wastewater Analysis and Quality Requirements
Staff Contact: Ms P.A. FitzGerald
CP12 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
CP12 S2

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
Wastewater Treatment and Disposal
Staff Contact: Mr P.J. Bliss
CP12 S2

Application of processes and process variations used to improve the quality of wastewaters and 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: Prof T.D. Waite
CP12 S2

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 and regulatory criteria relating to water use and re-use systems.

CIVL9860
Investigation of Groundwater Resources
Staff Contact: Dr R.I. Acworth
CP12 S1

Physical properties of groundwater. Darcy flow; porosity, hydraulic conductivity and intrinsic permeability - field and laboratory tests. Principles of groundwater flow. Storage and transmissivity. Groundwater in the hydrological cycle; flow nets; local and regional flow systems; springs; interactions with surface water. Drilling methods; well design and completion. Borehole geophysical methods. Solutions to the radial flow equation; pumping test interpretation. Groundwater modelling; finite difference methods. Program of field work and data analysis.

CIVL9861
Remote Sensing in Contaminated Site Assessment
Staff Contact: Dr R.I. Acworth
CP12 SS
Prerequisite: CIVL9860
Note/s: This subject is not offered every year.

Electrical properties of water, soil, rock and contaminants. The frequency dependence of electrical conductivity/relative permittivity. Relationships between porosity, clay content, fluid conductivity and bulk electrical conductivity.Electrical conductivity sounding and profiling using galvanic and induction methods. Electrical conductivity imaging. Forward and inverse modelling of conductivity images. Electrical tomography. Time domain electromagnetic methods. Ground probing radar. Time domain reflectrometry measurements. Gamma, neutron and FM borehole measurements. New technologies. Case studies related to contaminated site assessment.

CIVL9862
Fluvial Hydraulics
Staff Contact: A/Prof R.J. Cox
CP12 S2

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: Dr D.A. Luketina
CP12 S1

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.

CIVL9866
Flood Design
Staff Contact: A/Prof I. Cordery
CP12 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.

CIVL9867
Flood Modelling
Staff Contact: A/Prof I. Cordery
CP12 S1

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

CIVL9871
Water Supply and Sanitation in Developing Countries
Staff Contact: Prof T.D. Waite
CP12 S1

Selection of appropriate technology for water supply and wastewater treatment and disposal to account for hot climates and low per capita incomes. Design basis for systems and the operating requirements.

CIVL9872
Solid Waste Management
Staff Contact: Mr S.J. Moore
CP12 SS
Note/s: This subject is not offered every year.

Characterisation of municipal solid waste; collection; transfer stations; waste minimization and recycling; waste treatment, including size reduction, composting, 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
CP12 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: Dr A. Sharma
CP12 S2

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.

CIVL9880
Groundwater Modelling
Staff Contact: Dr R.I. Acworth
CP12 S2

Groundwater modelling of porous media, fractured rock and low permeability material. Numerical modelling, including finite difference and finite element methods. Regional groundwater and multi phase fluid flow modelling. Software packages and applications to borefield management, saltwater intrusion, mine dewatering and site contamination.

CIVL9881
Hazardous Waste Management
Staff Contact: Mr S.J. Moore
CP12 SS
Note/s: This subject is not offered every year.

Waste audits and characterisation of hazardous wastes in regions and industries; control of generation and transport of hazardous waste, manifest systems; waste minimisation; on-site treatment methods; integrated off-site treatment facilities; management of residues from treatment facilities; introduction to planning of regional hazardous waste management systems. Characteristics of individual waste types (dioxins, PCBs, pesticides, heavy metal, etc.) and waste management in individual industries (steel, pulp and paper, petro-chemical, food processing, etc.).

CIVL9884
Environmental Engineering Science 1
Staff Contact: Prof T.D. Waite
CP12 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 T.D. Waite
CP12 S2

Classification of soils and improvement of the engineering properties of soils. Aspects of soil chemistry relevant to contaminant behaviour of soils. 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
CP12 SS
Prerequisites or corequisites: CIVL9872, CIVL9881
Note/s: This subject is not offered every year.

A selection of at least 7 topics from the following to suit the class needs, expertise of visiting academics and researchers in the Cooperative Research Centre for Waste Management and Pollution Control, and issues of current interest. Background and basis of solid and hazardous waste classification and control systems; legislative and economic (market) regional pollution control mechanisms; developing techniques for waste minimisation; site selection and EIS preparation for waste facilities; dispersion of contaminants in the atmosphere; community consultation; detailed legislative requirements; application of systems concepts in waste management; environmental management plans; risk assessment at waste facilities; contaminated site characterisation and remediation; topics of interest to visiting academics; case studies by way of assignments.

CIVL9888
Environmental Management
Staff Contact: Mr S.J. Moore
CP12 S1

Spectrum of modern environmentalism and sustainable development; environmental impact statement techniques and EIA procedures; environmental management systems; tools for the analysis and management of environmental impacts of engineering projects, including environmental risk assessment, environmental and waste audits, Life Cycle Assessment and other materials accounting techniques.

CIVL9889
Environmental Economics and Law
Staff Contact: Mr S.J. Moore
CP12 S2

Introduction to economics of markets; sustainable development; pollution control; benefit-cost analysis; costing the environment. Regulatory procedures and requirements for new project development, and for the operation of facilities; including EIA and pollution control regulations with an emphasis on NSW.

CIVL9890
Spatial Decision Support Systems in Water Resources
Staff Contact: Dr J.E. Ball
CP12 SS
Note/s: This subject is not offered every year.

Principles of spatial decision support systems as used in hydrology, water resources and catchment management. Expert systems methods for decision modelling. Use of geographic information systems in surface and subsurface data analysis, model integration and presentation. Development and use of databases for water resources applications. Review of techniques for spatial data collection including remote sensing and global positioning systems.

CIVL9891
Groundwater Contamination and Remediation
Staff Contact: Dr R. I. Acworth
CP12 S1

Description of types of groundwater contaminants, sources of groundwater contamination, review of transport equations, mass transport in saturated media, advection and dispersion, biological and chemical transformation of groundwater contaminants, multiphase flow, migration of nonaqueous phase liquids. Groundwater sampling and analysis, monitoring well design and installation, soil-water and soil-gas monitoring. Treatment and prevention of

groundwater contamination. Site investigation methods at contaminated sites. Site remediation: source control, pump and treat, soil vapour extraction, bioremediation.

CIVL9901
Special Topic in Civil Engineering
CP12 SS

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

CIVL9902
Special Topic in Civil Engineering
CP12 SS

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

CIVL9909
Project
CP36

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.

Computer Science and Engineering

Head of School
Associate Professor P.J. Compton

Executive Assistant to Head of School
Dr G. R. Whale

School Office Manager
Mr C. Flatters

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 into the Departments of Artificial Intelligence, Computer and Systems Technology, Information Science and Software Engineering. 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 of Computer Science and Engineering, together with the School of Electrical Engineering, jointly administers the BE Computer Engineering **3645**.The BE Software Engineering **3648** which commences in 1997, is jointly managed with the School of Information Systems. Also commencing in 1997, is the BE MBiomedE **3728** which is managed in conjunction with the Graduate School of Biomedical Engineering. The School of Computer Science and Engineering offers a major in Computer Science in the BSc (Science and Mathematics), combined BE BSc degree courses **3681**, **3725**, **3726**, combined BE BA course **3722** and combined BSc LLB course **4770**.

The graduate courses offered are the Master of Engineering Science **8685**, the Master of Computer Science **8680**, Master of Information Science **8508**. Graduate Diploma in Computer Science **5452**, and Graduate Diploma in Information Science **5453**. 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**.

Summary of Undergraduate Courses

Normal full-time

Course and Degree(s)	Duration
3645 BE in Computer Engineering	4 years
3648 BE in Software 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
3728 BE MBiomedE 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
3746 BE BSc in Geomatic Engineering	5 years

Majors

Course and Degree	Duration
3978 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 courses, see the entries in this Handbook for the schools conducting the engineering major. The BSc degree course is described in the Science Handbook. Majors are offered in Computer Science and Psychology, Computer Science and Geography, 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.

Computing Requirements

Information regarding recommended computing equipment and software for the course is available from the School of Computer Science and Engineering Office.

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.

		HPW S1	HPW S2	CP
Year 1				
ACCT9001	Introduction to Accounting A	1.5	0	7.5
ACCT9002	Introduction to Accounting B	0	1.5	7.5
COMP1011	Computing 1A	6	0	15
COMP1021	Computing 1B	0	6	15
ELEC1011	Electrical Engineering 1	0	6	15
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	15
MATH1081	Discrete Mathematics	6	0	15
PHYS1969	Physics 1 (Electrical Engineering)	6	6	30

Total HPW Session 1 25.5
Total HPW Session 2 25.5
Total Credit Points 135

		HPW S1	HPW S2	CP
Year 2 (Revised)				
COMP2011	Data Organisation	5	0	**15**
COMP2021	Digital System Structures	5	0	**15**
COMP2031	Concurrent Computing	0	5	**15**
ELEC2011	Systems Theory	0	2.5	**6.5**
ELEC2030	Circuit Theory	3.5	0	**9**
ELEC2033	Electronics 1	0	4	**10**
MATH2510	Real Analysis *or*			
MATH2610	Higher Real Analysis	2.5	0	**7.5**
MATH2520	Complex Analysis *or*			
MATH2620	Higher Complex Analysis	0	2.5	**7.5**
MATH2849	Statistics EE	0	3	**9**
MATH3150	Transform Methods	0	2	**7.5**
PHYS2959	Introductory Semiconductor Physics	1.5	0	**5**
General Education subject/s		2	2	**15**

Total HPW Session 1 19.5
Total HPW Session 2 21
Total Credit Points 122

Students must attain a mark of 70CR or better in MATH1231 or MATH1241 in order to do Higher Level MATH subjects.

		HPW S1	HPW S2	CP
Year 3				
COMP3111	Software Engineering	0	5	**15**
COMP3121	Algorithms and Programming Techniques	5	0	**15**
COMP3211	Computer Organisation and Design	4	0	**15**
COMP3221	Microprocessors and Interfacing	0	5	**15**
ELEC3004	Signal Processing 1	4	0	**10**
MATH2501	Linear Algebra *or*			
MATH2601	Higher Linear Algebra	5	0	**15**
MATH3141	Mathematical Methods EE	0	4	**10**
COMP0001	Total Quality Management	0	3	**7.5**
Option A		5	0	**12**
Option B		0	5	**12**
General Education subject/s		2	2	**15**

Total HPW Session 1 25
Total HPW Session 2 24
Total Credit Points 141.5

Recommended Options for the four streams are listed below:

Communications Stream
Option A: ELEC3006 Electronics 2
Option B: ELEC3013 Communications Systems 1

Electronics Stream
Option A: ELEC3006 Electronics 2
Option B: ELEC3016 Electronics 3

Systems and Control Stream
Option A: ELEC3006 Electronics 2
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 *or*
COMP3231	Operating Systems
and	
COMP3331	Computer Networks and Applications *or*
ELEC4351	Data Communication and Computer Networks

Computing Stream
Option A: Any Level III/IV Computer Science subject *or* ELEC3006 Electronics 2
Option B: Any Level III/IV 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 IV Computer Science subjects in Year 4.

A complete list of the Level III and Level IV Computer Science subjects is given later in this section.

		HPW S1	HPW S2	CP
Year 4				
5 Professional Electives*		15	10	**60**
COMP4903	Industrial Training	0	0	**0**
COMP4910	Thesis Part A	7	0	**15**
COMP4911	Thesis Part B	0	14	**30**
IROB2721	Managing People	4	0	**15**

Total HPW Session 1 26
Total HPW Session 2 24
Total Credit Points 120

Notes:

1. Professional Electives may be chosen from Level III/IV 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.

All students are required to complete at least two Level IV subjects.

2. All students in the BE Computer Engineering course must complete at least 60 days of approved industrial training before the end of Year 4.

Professional Electives

Communications Stream

ELEC3016	Electronics 3
ELEC4042	Signal Processing
ELEC4303	Electromagnetic Wave Propagation
ELEC4313	Optical Communications
ELEC4323	Digital and Analog Communications
ELEC4351	Data Communication and Computer Networks
ELEC4352	Data Networks 2
ELEC4503	Advanced Electronic Circuits
ELEC4512	Semiconductor Devices
MATH3411	Information, Codes and Ciphers

Electronics Stream

COMP4215	VLSI Systems Architecture and Design
ELEC4042	Signal Processing
ELEC4303	Electromagnetic Wave Propagation
ELEC4503	Advanced Electronic Circuits
ELEC4512	Semiconductor Devices
ELEC4522	Microelectronics Design and Technology
ELEC4532	Integrated Digital Systems
ELEC4540	Applied Photovoltaics

Systems and Control Stream

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

Computing Stream

Level IV Computer Science Subjects

COMP4001	Object-Oriented Software Development
COMP4141	Theory of Computation
COMP4415	Artificial Intelligence: Foundations
COMP9115	Programming Languages
COMP9116	Software System Development
COMP9215	VLSI Systems Architecture and Design
COMP9242	Advanced Operating Systems
COMP9314	Next Generation Database Systems
COMP9416	Knowledge Based Systems
COMP9417	Machine Learning
COMP9444	Neural Networks
COMP9514	Advanced Decision Theory for Information Science
COMP9517	Image Processing and Application
COMP9518	Pattern Recognition and Vision

These subjects may only be taken as Professional Electives if all other Professional Elective requirements have been met.

Level III Computer Science Subjects

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

Award of Honours

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

Honours Class 1: WA ≥ 75

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

Division 2: 65 ≤ WA < 70

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 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.

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 and Social Sciences 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.

3728 Computer Engineering/Biomedical Engineering -Full-time Course

Bachelor of Engineering Master of Biomedical Engineering BE MBiomedE E

The BE(Computing)/Master of Biomedical Engineering concurrent degree program is offered jointly through the School of Computer Science and Engineering and the Graduate School of Biomedical Engineering

For more detailed information about the course, please see the entry in the Biomedical Engineering section of this handbook.

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 and 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.

Organisation

The BE BA course is administered by the School of Computer Science and 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 and Social Sciences Faculty Handbook describes the options, and the School of Computer Science and 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 Computer Science and 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:
120 credit points, including a major sequence

Other Faculties:
Major sequence plus at least 30 credit points from Schools of the Faculty of Arts and Social Sciences

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

2. There will be a testamur for each part of the combined degree course.

3. Students who complete the BE program first may proceed to graduation with the degree of Bachelor of Engineering in the usual way.

4. 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.

Honours

In the Faculty of Engineering, Honours are awarded for superior performance in the standard program. In the Faculty of Arts, the award of honours requires a separate program involving at least one further year of study, as detailed in the Faculty of Arts and Social Sciences Handbook.

3726
BE BSc in Computer Engineering

Students who achieve a creditable performance in the first two years of their Computer Engineering course may 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 prerequisites, 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 complete Year 4 of the Computer Engineering course **3645**. The program below outlines the course of study:

Year 1 (Standard Program for course 3645)
ACCT9001, ACCT9002
COMP1011, COMP1021,
ELEC1011,
MATH1131 or MATH1141,
MATH1231 or MATH1241,
MATH1081,
PHYS1969

Year 2
COMP2011, COMP2021, COMP2031,
ELEC2011, ELEC2030, ELEC2033,
MATH2011, MATH2620, MATH2849, MATH3150,
PHYS2959,
For Physics majors the 1.5 hour subject PHYS2959 is replaced by the 6 hour subject PHYS2949 Physics 2E which is taken over two years. The Solid State Physics component (3.5 HPW) is completed in year 2 and Electromagnetism (2.5 HPW) in year 3. Mathematics subjects may be taken at the ordinary level.

Mathematics majors may include MATH2601 from the Year 3 program.

Year 3
COMP0001, COMP3111, COMP3121, COMP3211, COMP3221,
ELEC3004,
MATH2601, MATH3141

Elective subjects in Computer Science and/or Electrical Engineering, General Education.

Mathematics majors should take the higher level subject MATH2601 in Year 2 or Year 3.

Physics majors are required to complete PHYS2949 and add the following subject 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):

PHYS2999Mechanics and Thermal Physics (F L1.5 T.5)

Year 4
Mathematics
General Education subject/s.
Choose at least 5 Mathematics subjects, 4 of which are Level III.
Choose 3 Level II or Level III subjects from those available in Program 1000 of course 3970 (see Sciences handbook for details).
or
Physics
General Education subject/s.
Choose 7 Level II or Level III subjects from those available in program 0100 of course 3970 of which four must be Level III Physics subjects 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.

Students wishing to gain a degree at Honours level in Science as part of their combined degree program must meet all the relevant requirements of 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 School of Computer Science and Engineering and with the approval of the Head of the appropriate Science school, the Faculty of Engineering and the Board of Studies in Science and Mathematics. AUSTUDY support is available for the combined degree program including Honours level Science.

3648 Software Engineering – Full-time Course

Bachelor of Engineering
BE

The software industry is one of the fastest growing industries in the world. Even companies that have been associated largely with hardware in the past are estimating that 80-90% of their engineers are involved, or will be involved by the year 2000, in software development. Graduates in software engineering will be well equipped for employment with any company that develops significant software systems. These will include the telecommunications, electronics, middle ware, security, and defence industries.

The course is jointly administered by the School of Computer Science and Engineering and the School of Information Systems, but day-to-day administration of the course is conducted through the Computer Science and Engineering School Office, Room 313 Electrical Engineering building, to which enquiries should be directed.

		HPW S1	HPW S2	CP
Year 1				
SENG1010	Software Engineering Workshop 1A	3	0	**7.5**
SENG1020	Software Engineering Workshop 1B	0	3	**7.5**
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	**15**
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	**15**
MATH1081	Discrete Mathematics	0	6	**15**
COMP1011	Computing 1A	0	6	**15**
COMP1021	Computing 1B	6	0	**15**
NFS1603	Business Data Management	3	0	**15**
INFS1611	Requirements Engineering	1.5	0	**7.5**
1 elective Science subject				
Any session 1 or session 2 subject listed in the Science or Engineering Handbooks, subject to approval.		6	0	**15**

Total HPW Session 1 **25.5**
Total HPW Session 2 **21**
Total Credit Points **127.5**

Year 2				
SENG2010	Software Engineering Workshop 2A	2.5	0	**7.5**
SENG2020	Software Engineering Workshop 2B	0	2.5	**7.5**
COMP2110	Software System Specification	2.5	0	**7.5**
COMP2011	Data Organisation	5	0	**5**
COMP2021	Digital Systems Structures	0	5	**15**
COMP2411	Logic & Logic Programming	5	0	**15**
COMP3511	Human-Computer Interaction	0	5	**15**
INFS2603	System Analysis & Design	3	0	**15**

		HPW S1	HPW S2	CP
INFS3604	Information Function Management	0	3	15
MATH2869	Applied Statistics SC	2	0	7.5
General Education subject/s		0	4	15

Total HPW Session 20
Total HPW Session 2 19.5
Total Credit Points 135

Year 3

SENG3010	Software Engineering Workshop 3A	2.5	0	7.5
SENG3020	Software Engineering Workshop 3B	0	2.5	7.5
COMP3121	Algorithms and Programming Techniques	0	5	15
COMP3131	Parsing and Translation	0	5	15
COMP3141	Software System Design & Implementation	5	0	15
COMP3231	Operating Systems	0	5	15
COMP3311	Database Systems *or*			
INFS3608	Advanced Database Systems	5	0	15
COMP3331	Computer Networks & Applications	5	0	15
INFS2607	Business Data Networks	0	3	15
General Education subject/s		4	0	15

Total HPW Session 1 21.5
Total HPW Session 2 20.5
Total Credit Points 135

Although either of the alternative subjects shown would be acceptable for this course, the two Schools will design and propose a new single subject to replace the choice.

		HPW S1	HPW S2	CP
Year 4				
INFS2610	Reuse and Windows Programming	3	0	15
4 Electives from Elective list		10	10	60
SENG4921	Professional Issues and Ethics	4	0	15
SENG4903	Industrial Training	0	0	0
SENG4910	Thesis part A	7	0	15
SENG4911	Thesis part B	0	14	30

Total HPW Session 1 24
Total HPW Session 2 24
Total Credit Points 135

Electives

COMP3241	Real-Time Systems	0	5	15
COMP3221	Microprocessors and Interfacing	0	5	15
COMP9416	Knowledge-Based Systems	0	5	15
INFS3603	Executive Support Systems	3	0	15
INFS4811	Knowledge Based Information Systems	0	3	15
MATH2301	Mathematical Computing A	4	0	15
MATH3411	Information, Codes and Ciphers	0	4	15
Approved subjects at level 4 or higher				

Award of Honours

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

Honours Class 1: WA ≥ 75

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

Graduate Study

The formal graduate courses offered are the Master of Computer Science **8680,** Master of Information Science **8508,** Graduate Diploma in Information Science **5453,** Graduate Diploma in Computer Science **5452.**

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

The postgraduate degrees offered by the School of Computer Science and Engineering allow for flexibility of choice between formal course work and research and are available on a full or part-time basis which will be attractive to people working in industry. Most compulsory subjects are available in an evening (6pm-9pm) or late afternoon (4pm-7pm) pattern.

The range of choice in subjects is wide allowing individual specialisation and breadth aspirations to be satisfied. There is opportunity to choose subjects from other disciplines, offered by this and other universities, providing they are of suitable graduate standard.

Graduate Programs in Information Science

The Information Science program has been designed to be taken by students from areas such as computer science, information systems, communications engineering, librarianship and ergonomics. A deep knowledge of

computing *theory* is not required, but it is important to have considerable computing experience and to be aware of the features of the data processing environment. Familiarity with the way in which decision making and specification of user needs occur in the 'real world' is assumed. This is necessary to allow the student to appreciate how the elements of *Information Science* fit together. The MInfSc program will elaborate detail of the facets of the discipline and the project work will integrate the topics.

8508
Master of Information Science
MInfSc

The MInfSc degree program involves both course work and a project. Material from a number of disciplines is presented to provide the integration needed for this interdisciplinary area. The project component of the MInfSc degree assists in this integration. The typical duration of this course is; three sessions full-time or five sessions part-time.

Masters candidates are required to complete a program totalling 180 credit points. This may be taken in one of two ways:

Major Project Option made up of 90 credit points s of core subjects, and a 90 credit point project.

Course Work Option made up of 90 credit points of core subjects, a 15 credit point Networks subject, 45 credit points of elective subjects, and a 30 credit point project.

Elective subjects may be chosen after consulting the graduate adviser on the content and credit point value of the subjects.

Students should note that the decision to take course work or major project option will not be made until the first 60 credit points (4 subjects) have been completed. The major project option is only intended for full-time students and is only available to those with high grades in the first four subjects.

5453
Graduate Diploma in Information Science
GradDip

The GradDip in Information Science degree is a course work only program.

The typical duration of this course is two sessions full-time or four sessions part-time.

Graduate Diploma candidates are required to complete a program totalling 120 credit points (typically 8 subjects). This involves 90 credit points made up of core subjects and two electives chosen after consulting the graduate adviser.

Core Subjects

The following list of core subjects must be completed by all who are undertaking the Graduate Diploma and Masters program:

1. COMP9311 Introduction to Database Systems
2. COMP9514 Advanced Decision Theory
3. COMP9511 Human-Computer Interaction

   One subject from each of the following groups:
4. COMP9314 Next Generation Databases
   COMP9315 Database System Implementation
5. COMP9414 Artificial Intelligence
   COMP9416 Knowledge Based Systems
   INFS5927 Knowledge Based Systems
   INFS5991 Decision Support Systems
6. GEOG9150 Remote Sensing Applications
   LIBS0817 Information Storage and Retrieval
   GMAT9604 Land Information Systems

Graduate Programs in Computer Science

The Master of Computer Science course is a postgraduate course aimed towards graduates who have a *four year degree in science or engineering* and wish to become computing professionals. This two year full-time course addresses all aspects of modern computing systems, including its hardware, its software and its applications.

The Master of Engineering Science course is aimed at providing specialised postgraduate education in Computer Science and Engineering to practitioners and professionals who already have a four year undergraduate degree in computing. The flexibility in the course allows students to choose from specialising in a number of areas, including software engineering, computer systems engineering, database systems, knowledge-based systems, and visual information processing. The subject offerings will be continually evaluated for their relevance and recency.

Students who are not eligible for entry to the Master of Computer Science or who wish to take a shorter postgraduate qualification may apply for the Graduate Diploma in Computer Science.

The typical duration of these courses are:
MCompSc, four sessions full-time or eight sessions part-time.
MEngSc, 2 sessions full-time or four sessions part-time.
GradDipCS, three sessions full-time or six sessions part-time.

8685 Master of Engineering Science in Computer Science and Engineering
MEngSc

Master of Engineering Science in Computer Science and Engineering students complete a program of 120 credit points of study. The program can be completed in two modes:

Course Work Option
8 - 15 CP subjects

or
Course work and Project Option
5 - 15 CP subjects, and
45 CP project taken during the final session.

The project option is only available to students who (a) have achieved a credit average (65%) in the first 60 CP of subjects attempted; and (b) have obtained approval for their proposed topic from the potential supervisor and the School's Graduate Adviser.

Postgraduate subjects in the School of Computer Science and Engineering are divided into four groups. Each subject is worth 15 CP.

The number of credit points which must be taken from each group is given below:

Mode: Coursework only

Group B & C	max 45 CP
Group D	min 45 CP
Other	-

Mode: Coursework and project

Group B & C	**max 30 CP**
Group D	**min 45 CP**
Other	**45 CP project**

A student may be allowed to take up to two postgraduate subject from other schools with prior approval from the Graduate Adviser. Approved subjects are counted as Group D substitutions.

In the event that an approved postgraduate subject is taken from another school in the University, a minimum of 114 CP must be completed satisfactorily before the award be granted. This allows 12 CP subjects within the Faculty of Engineering to be fully counted.

8680
Master of Computer Science
MCompSc

Master of Computer Science students complete a program of 240 credit points (CP) of study. The program can be completed in two modes:

Coursework Option
16 - 15 CP subjects
or
Coursework and Project Option
12 - 15 CP subjects, and a
60 CP project taken during the final session.

The project option is only available to students who (a) have achieved a credit average (65%) in the first 60 CP of Group B subjects attempted; and (b) have obtained approval for their proposed topic from the potential supervisor and the School's Graduate Adviser.

Postgraduate subjects in the School of Computer Science and Engineering are divided into four groups. Each subject is worth 15 CP.

The number of credit points which must be taken from each group is given below:

Mode: Coursework

Group A	60 CP
Group B	90 CP
Group C	30 CP
Group C & D	60 CP
Other	-

Mode: Coursework and Project

Group A	60 CP
Group B	90 CP
Group C	-
Group C & D	30 CP
Other	60 CP project

Under both options, a student may be allowed to take up to two postgraduate subject from other schools with prior approval from the Graduate Adviser. Approved subjects are counted as Group D substitutions.

In the event that an approved postgraduate subject is taken from another school in the University, a minimum of 234 CP must be completed satisfactorily before the award be granted. This allows 12 CP subjects within the Faculty of Engineering to be fully counted.

5452
Graduate Diploma in Computer Science
GradDip

Graduate Diploma students are required to complete a program of 180 credit points (CP) of study. The program can be completed by completing 12 x 15 CP subjects.

Postgraduate subjects in the School of Computer Science and Engineering are divided into four groups. Each subject is worth 15 CP.

The number of credit points which must be taken from each group is given below:

Mode: Coursework only

Group A	60 CP
Group B	90 CPP
Group C & D	30 CP
Other	-

A student may be allowed to take one postgraduate subject from other schools with prior approval from the Graduate Adviser. Approved subjects are counted as Group D substitutions.

In the event that an approved postgraduate subject is taken from another school in the University, a minimum of 177 CP must be completed satisfactorily before the award be granted. This allows 12 CP subjects within the Faculty of Engineering to be fully counted.

Postgraduate Subjects

Group A
Group A consists of bridging material in computing taught at an accelerated pace for MCompSc and GradDip in CS students. Students who are able to demonstrate that they have thoroughly covered equivalent material in their previous studies may request exemptions from some or all of these subjects. These subjects are not available in MEngSc for credit.

COMP9020	Foundations of Computer Science
COMP9021	Principles of Programming
COMP9022	Digital System Structure
COMP9023	Functional Programming

Group B
Group B subjects constitute the knowledge in computing that every postgraduate student in computing should possess. Assumed Knowledge of many of these subjects is essential before admission to the MEngSc course can be given. A MEngSc student will have limited opportunity to take some of these subjects.

COMP9008	Software Engineering
COMP9101	Design & Analysis of Algorithms
COMP9201	Operating Systems
COMP9214	Computer Architectures
COMP9311	Database Systems
COMP9414	Artificial Intelligence

Group C
Group C subjects constitute the secondary core subjects that emphasise important aspects of computing, but due to time constraints it is not feasible to expect students to take all of them. A MEngSc student will be able to include some of them in their course of study.

COMP9102	Compiling Technique
COMP9221	Microprocessor Systems
COMP9331	Computer Networks & Applications
COMP9415	Computer Graphics
COMP9511	Human Computer Interactions

Group D
The subjects of interest to the MEngSc course are mainly from Group D. These are advanced electives that can be used by a MEngSc student to gain specialisation in one of several areas of computing.

COMP9115	Programming Languages
COMP9116	Software System Development
COMP9211	Computer organisation & Design
COMP9215	VLSI System Design
COMP9216	Parallel & Distributed Operating Systems
COMP9231	Integrated Digital
COMP9242	Advanced Operating Systems
COMP9314	Next Generation Database Systems
COMP9315	Database System Implementation
COMP9416	Knowledge-Based Systems
COMP9417	Machine Learning
COMP9444	Neural Networks
COMP9514	Advanced Decision Theory
COMP9517	Image Processing & Application
COMP9518	Pattern Recognition & Vision

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organisational 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
CP8 S2 L2 T1
Prerequisites: MATH2859 or MATH2849

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 A. Taylor
CP15 S1 or S2 L3 T3
Prerequisites: as for MATH1131
Co-requisites: MATH1131 or MATH1141
Note/s: Excluded COMP1811

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. Introduction to software engineering and professional ethics *Lab*: programming assignments.

COMP1021
Computing 1B
Staff Contact: Dr J. Shepherd
CP15 S1 or S2 L3 T3
Prerequisites: COMP1011
Note/s: Excluded COMP1821

Introduction to procedural programming. *Control structures:* selection, recursion and iteration. *Abstract Data Types:* lists, stacks, queues, trees. Implementation in a procedural language (C) using linked structures. Searching and sorting. The layered model of a computer, instruction set, execution cycle, data storage, assembly language programming. *Lab*: programming assignments.

COMP2011
Data Organisation
Staff Contact: Dr G. Whale
CP15 S1 or S2 L3 T2
Prerequisites: COMP1021 or COMP1821

Data types and data structures: abstractions and representations; dictionaries, priority queues and graphs; AVL trees, splay trees, B-trees, heaps. *File Structures:* storage device characteristics, keys, indexes, hashing. Memory management. *Lab*: programming assignments including group project.

COMP2021
Digital System Structures
Staff Contact: Dr G. Heiser
CP15 S1 or S2 L3 T2
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. *Lab*: take-home logic kits; programming assignments.

COMP2031
Concurrent Computing
Staff Contact: Dr A. Sowmya
CP15 S2 L3 T2
Prerequisites: COMP1021 or COMP1821

The process model: sequential versus parallel computation. *Interprocess communication and synchronisation mechanisms:* co-routines, 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. *Lab*: programming assignments.

COMP2110
Software System Specification
Staff Contact: Mr Ken Robinson
S1 HPW 2.5 CP7.5
Prerequisite: COMP1021 Corequisite: INFS2603

Formal specification: set theory, logic, schema calculus, case studies. the Z specification notation. The relationship between informal specification methods such as data flow, and Object-Oriented methods, such as OMT, and formal methods like Z. This subject will attempt to develop the case for rigorous specification methods. Project work for this subject will be done within SENG2010.

COMP2411
Logic and Logic Programming
Staff Contact: School Office
S1 HPW 5 CP15

Introduction to logic for computer scientists: an elementary exposition of propositional logic and predicate logic from a computational point of view, including introduction to interpretations, models, proof procedures, soundness, and completeness.
Automated deduction: clausal form logic and Horn clause logic, skolemization, the Herbrand domain, unification, resolution and resolution strategies.
Logic Programming: data representation, operational views of unification and backtracking, the notion of logical variable, reversibility, non-logical features, meta-programming, introduction to constraint logic programming and other paradigms, extensive practical work.

COMP3111
Software Engineering
Staff Contact: Mr K. Robinson
CP15 S1 or S2 L3 T2
Prerequisites: COMP2011
Note/s: Excluded COMP9008.

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 life cycle. CASE tools. A major group project is undertaken.

COMP3121
Algorithms and Programming Techniques
Staff Contact: Dr A. Goswami
CP15 SS L3 T2
Prerequisites: COMP2011
Note/s: Excluded COMP9101.

Correctness and efficiency of algorithms. Computational complexity: time and space bounds. Techniques for best-case, worst-case and average-case time and space analysis. Designing algorithms using induction, divide-and-conquer and greedy strategies. Algorithms: sorting and order statistics, trees, graphs, matrices. Intractability: classes P, NP, and NP-completeness, approximation algorithms.

COMP3131
Parsing and Translation
Staff Contact: Mr K. Robinson
CP15 S2 L3 T2
Prerequisites: COMP2011
Note/s: Excluded COMP9102.

Grammars: formal description, Chomsky hierarchy, EBNF, attributed-grammars. *Top-down parsing:* LL(k) grammars, construction of recursive-descent parsers. *Bottom-up parsing:* LR(k) grammars, construction of LR sets, LR-parser generators. *Lexical analysis:* regular expressions, finite automata, linear grammars. *Compilation:* introduction to code generation and optimisation. *Lab*: compiling techniques using functional models and translator generators.

COMP3141
Software System Design & Implementation
Staff Contact: Mr Ken Robinson
S1 HPW 5 CP15
Prerequisite: COMP2110 or COMP3111

This subject will present rigorous and formal methods for the design and implementation phases of software system development. Also considered are testing and reuse of designs. As far as possible, software tools that can assist the process will be used. The material will be presented using case studies, and students will be required to undertake a project.

COMP3211
Computer Organisation and Design
Staff Contact: Prof G. Hellestrand
CP15 S1 L3 T2
Prerequisites: COMP2021 or ELEC2012
Note/s: Excluded COMP9211.

Combinatorial and sequential circuit design; synchronisation, communication and arbitration; register

transfer specification (Modal). Arithmetic Design Strategies. *Memory Organisation:* physical and virtual address space; operating system and compiler support; memory mapping and caching. *Communications Organisation:* shared memory, memory mapping; network systems. *Processor Design:* the instruction pipeline; hardwired and micro-programmed control; instruction sets; RISC and object-based processor organisation. Error Detection/Correction and Fault Tolerance; coding theory. *Lab*: major design project.

COMP3221
Microprocessors and Interfacing
Staff Contact: Dr S. Matheson
CP15 S2 L3 T2
Prerequisites: COMP2021
Note/s: Excluded ELEC2041, 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. *Lab*: experimental work involving hardware and software.

COMP3231
Operating Systems
Staff Contact: Dr Jayasooriah
CP15 S1 or S2 L3 T2
Prerequisites: COMP2011, COMP2031 OR ELEC3020
Note/s: Excluded COMP9201.

Operating system organisation 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, MS-DOS and Mach. Lab: programming assignments.

COMP3241
Real-Time Systems: Specification, Design and Implementation
Staff Contact: Dr John Zic
S1 HPW 5 CP15
Prerequisite: COMP3211 and (COMP3111 of COMP2110)
Note/s: Not offered in 1997.

System taxonomy. Time and causality. Characteristics of real-time systems and their environment.
Structured design techniques overview: Real-time Structured Analysis and Design (RTSAD); Design Approach for Real-Time Systems (DARTS); Real-Time Object Oriented Design techniques such as HRT-HOOD.
Performance analysis: scheduling tasks (rate montonic, generalised rate, slack scheduling); timed trace analysis; reliability analysis.
From design to implementation: use of real-time development system and associated language.
Design project using a structured design technique and a development environment. example projects include: gas-burner control system, automated teller machine, mine control system, rail control or automotive cruise control.

COMP3311
Database Systems
Staff Contact: Dr A. Ngu
CP15 S1 L3 T2
Prerequisites: COMP2011
Note/s: Excluded COMP9311.

The relational database model object-oriented databases, 4GL query languages, optimisation, database design principles are realised through a major project involving both design and implementation of a database application using a sophisticated DBMS system. *Lab*: programming assignments.

COMP3321
Business Systems Organisations
Staff Contact: School Office
CP15 SS L3 T2
Prerequisites: COMP2011
Note/s:. Not offered in 1997.

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

COMP3331
Computer Networks and Applications
Staff Contact: Dr J. Zic
CP15 SS L3 T2
Prerequisites: COMP2011
Note/s: Excluded COMP9331.

Networking technology and protocol overview. *Local Area Networks:* architectures; media; generalised Medium Access Control methods. IEEE802 LAN standards. *Datalink layer:* design principles and protocols such as stop and wait, sliding windows, and Automatic Repeat Request schemes. *Network Layer:* design principles; addressing; message routing; congestion and traffic control. *Internetworking:* issues; bridges and routers. The Internet Protocol (IP) and the Internet. Internet Routing via exterior and interior router level protocols such as EGP, RIP, OPSF and HELO. Internet Transport Control Protocol (TCP). RPC and Session control. Network management using SNMP. The Domain Name System (DNS). Mail systems. File transfer protocols. Encryption and Security. A view to the future of networking.

COMP3411
Artificial Intelligence
Staff Contact: A/Prof C. Sammut
CP15 S1 L3 T2
Prerequisites: COMP2011
Note/s: Excluded COMP9414.

Machine intelligence. *Principles:* knowledge representation, automated reasoning, machine learning. *Tools:* AI 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. *Lab*: logic programming assignments.

COMP3421
Computer Graphics
Staff Contact: Dr T. Lambert
CP15 SS L3 T2
Prerequisites: COMP2011
Note/s: Excluded 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. *Lab*: programming assignments.

COMP3511
Human-Computer Interaction
Staff Contact: Dr C. N. Quinn
CP15 S1 L3 T2
Prerequisites: COMP2011
Note/s: Excluded COMP9511.

Provides an introduction to user-system interactions, both analysis and design. The approach is cognitive, focusing on matching user goals with computer technologies. *The Topics:* the human information processing system, models of interaction, strategies for and process of design and evaluation. Project work is emphasised.

COMP4001
Object-Oriented Software/Development
Staff Contact: Dr I. Gorton
CP12 S1 L3T1

This course will cover object-oriented design and implementation methods for complex software systems. Topics covered include: object-oriented program design techniques, object-oriented programming in C++, software reuse and designing for reuse, design patterns and styles, object persistence and distribution. Examples from a wide range of application areas will be used at all stages to illustrate concepts and techniques. Assessment will involve two short assignments and one substantial programming project to be carried out in small groups.

COMP4011
Occasional Elective S1 (Computer Engineering)
Staff Contact: School Office
CP12 S1 L3 T1
Prerequisites: Any 4 Level III Computer Science subjects

A program of advanced course work 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: Dr P. Maheshwari
CP12 S2 L3 T1
Prerequisites: COMP3121 or COMP9101
Note/s:

*Parallel Computation Models:*PRAM, Linear Array, Ring, Mesh, Tree, Hypercube, Shared-Memory vs. Distributed-Memory Machines. *Design and Analysis of Parallel Algorithms:* Matrix Multiplication, FFTs, Sorting, Searching, Graph Algorithms, Dynamic Programming. Mapping and Scheduling of Parallel Programs. Parallel Programming Paradigms. *Supercomputer Architectures:* CM-5, SGI Power Challenge, HP Convex SPP1200. *Assessment:* two major assignments and a final examination.

COMP4131
Programming Language Semantics
Staff Contact: Mr K. Robinson
CP12 S2 L3 T1
Prerequisites: Any 4 Level III 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
CP12 S1 L3 T1
Prerequisites: Two Level III 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
CP12 SS L3 T1
Prerequisites: COMP3211
Note/s: Excluded COMP9214. Not offered in 1997.

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

COMP4215
VLSI Systems Architecture and Design
Staff Contact: Prof G. Hellestrand
CP12 S1 L3 T1
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.

COMP4415
Artificial Intelligence: Foundations
Staff Contact: Dr A. Hoffmann
CP12 S1 L3 T1
Prerequisites: COMP3411 and one other Level III 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.

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 should be obtained in Australia. 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.

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, a nominal 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 academic staff. Usually, the Thesis involves the design and construction of experimental apparatus and/or software, together with appropriate testing and evaluation. For Part A, students are required to present a satisfactory seminar. For Part B, a written thesis must be submitted by the Tuesday of the final week of the session.

COMP9008
Software Engineering
Staff Contact: Mr K. Robinson
CP15 S1 HPW4
Assumed knowledge: COMP9024 or (COMP9020 and COMP9021)
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 group project is undertaken.

COMP9015
Issues in Computing
Staff Contact: School Office
CP15 S2 HPW3

A review of issues that affect the use of Computer Systems. Topics that may be covered include: the human implications of computing systems, the effect of computing operations on organisational structure, software copyright, privacy, the role of computing systems and information systems in decision making, the significance of the timeliness of information and its implication on the value of decision making and the requirements for a computing system.

COMP9020
Foundations of Computer Science
Staff Contact: School Office
CP15 S1 or S2 HPW3 *Co-requisite:* COMP9021

Sets, relations, function. Discrete probability. Combinatorics. Propositional logic, first-order predicate logic. Reasoning about programs: axiomatic semantics, pre/post-conditions, loop invariants. Order statistics. Recurrence relations. Application to searching and sorting. Abstract data types. *Data structures:* dictionaries, tree structures. Binary search trees, balanced trees, B-trees, expression trees.

COMP9021
Principles of Programming
Staff Contact: School Office
CP15 S1 or S2 HPW3
Corequisite: COMP9020
Note/s: Excluded COMP1811, COMP1021.

Introduction to the functional and procedural programming styles. Abstraction, types, functions, lists, recursion. Procedural programming: state, variables, types; control structures, functions. Realisation using a procedural language (currently C). Data types and data structures: sequential (lists, stacks, queues); hashing, priority queues, graphs. *Laboratory*: programming assignments.

COMP9022
Digital System Structures
Staff Contact: School Office
CP15 S1 or S2 HPW3
Assumed knowledge: procedural programming concepts of COMP9021
Note/s: Excluded COMP2021.

Multilevel computing system description: High-level language - Assembly language - Operating Systems - Machine Code - Microprogram - Digital Circuit. Introduction to Computer Systems: processor/bus/memory/peripherals, introduction to fetch/execute cycle, CPU Organisation. Digital circuit level: basic components (processing, storage, communication), hierarchical logic descriptions, data and control paths, register transfer language, simple CPU structure. Machine code level: data representation, registers, instruction sets, fetch/execute cycle, programmers model of computer. Assembly language level: assembly language and machine code, assembly language format, the assembly process, assembly language and high-level languages. *Laboratory*: take-home digital-circuit kits, programming assignments.

COMP9023
Functional Programming and Software Development
Staff Contact: School Office
CP15 S1 HPW3
Co-requisite: COMP9020
Note/s: Excluded COMP1011, COMP1821.

Functional programming techniques: currying, list comprehension, recursion and induction. Algebraic types; recursive types. Abstract data types in Miranda, Gofer. Introduction to software engineering: software lifecycle, requirements, specification, implementation, maintenance. *Laboratory*: programming assignments, software engineering project.

COMP9024
Data Structures, File Systems and Data Bases
Staff Contact: Dr A. Amin
CP15 S2 HPW3
Assumed knowledge: COMP9021 or COMP1021
Note/s: Excluded COMP2011.

The abstraction and representation of information. Data structures and abstract data types; Lists, stacks and recursion, queues, trees, graphs. Internal sorting. Practical work will use Modula-2 or C. Internal (memory) and external (file system) representation of information; B-trees, B+-trees, Hash tables; Files: sequential files, direct access files, indexed files. Introduction to databases and query languages. *Lab*: programming assignments.

COMP9101
Design and Analysis of Algorithms
Staff Contact: School Office
CP15 SS HPW3
Assumed knowledge: COMP9024,or (COMP9020 and COMP9021), or COMP2011
Note/s: Excluded COMP3121.

Techniques for design and performance analysis of algorithms for a variety of computational problems. Asymptotic notations, bounding summations, recurrences, best-case, worst-case and average-case analysis. Design techniques: divide-and-conquer, dynamic programming and memorisation, greedy strategy, backtracking, branch-and-bound. Algorithms: sorting and order statistics, trees, graphs and flow networks, matrices, arithmetic circuits. Intractability: classes P, NP, and NP-completeness, approximation algorithms.

COMP9102
Compiling Techniques and Programming Languages
Staff Contact: Mr K. Robinson
CP15 SS HPW3
Co-requisite: COMP9024, or (COMP9020 and COMP9021), or COMP2011
Assumed knowledge: Functional Programming COMP9023
Note/s: Excluded COMP3131.

Grammars: formal description, Chomsky hierarchy, EBNF, attributed-grammars. *Top-down parsing:* LL(k) grammars, construction of recursive-descent parsers. *Bottom-up parsing:* LR(k) grammars, construction of LR sets, LR-parser generators. *Lexical analysis:* regular expressions, finite automata, linear grammars. *Compilation:* implementation of scope, code generation and optimisation. *Lab*: use of translator-generators.

COMP9114
Formal Specification
Staff Contact: Mr K. Robinson
CP15 SS HPW3
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
CP15 SS HPW3
Assumed knowledge: Background to final year Computer Science level, equivalent to subjects COMP9008, COMP9101 and 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.

COMP9116
Software System Development Using the B-Method and B-Toolkit
Staff Contact: Mr K. Robinson
CP15 S1 HPW3
Prerequisite: COMP3111 or COMP9008

The B-Method is a rigorous mathematically based method for the development of reliable software. The method covers the complete software cycle from requirements analysis through specification, design, implementation, testing, maintenance, and re-use. The B-Method is supported by the B-Toolkit: a collection tools that provide for specification animation, proof obligation generation, theorem proving, configuration management, code generation, and documentation. The B-Method uses similar mathematical notation to Z, but does not use Z. Specifications are given in AMN (Abstract Machine Notation), which is a small abstract programming language. The B-Method is object based in the sense that systems of machines use a number of different forms of inheritance to control visibility and inherit operations. There is no dependence on a particular programming language, but the current code generator generates C.

This subject will explore the use of the B-Method and the B-Toolkit. The topics covered will include:

The Abstract Machine Notation; Machine Composition; Refinement; Implementation;

The method of presentation will use case studies to present the method; laboratory exercises to use the tools; a major project to apply all aspects of the method, and use of the tools.

COMP9201
Operating Systems for Engineers
Staff Contact: Dr Jayasooriah
CP15 S2 HPW3
Assumed knowledge: COMP9023 and COMP9024, or (COMP9020 and COMP9021)
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. *Lab*: programming assignments.

COMP9211
Computer Organisation and Design
Staff Contact: Prof G. Hellestrand
CP15 S1 HPW4
Assumed knowledge: ELEC2021 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 Organisation: physical and virtual address space; memory hierarchy; operating system and compiler support; memory mapping and caching.
Communications Organisation: shared memory, memory mapping; network systems. *Processor Design:* the instruction pipeline; hardwired and micro-programmed control; instruction sets; RISC and object-based processor organisation. Error Detection/Correction and Fault Tolerance; testing and testability; faults, errors and failures; coding theory; diagnosing and correcting errors. *Lab*: major design project.

COMP9214
Computer Architectures
Staff Contact: Dr S. Matheson
CP15 SS HPW3
Assumed knowledge: ELEC2021 or COMP9022
Note/s: Not offered in 1997.

Review of conventional computer architectures, description methods and performance evaluation. Alternative approaches to CPU, memory, communication, busses and I/O organisation. Influences on computer architecture, including technological innovation and new application areas. Case studies of specialised 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
CP15 SS HPW3
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
CP15 SS HPW3
Assumed knowledge: Background to final year Computer Science level, equivalent to subjects COMP3111, COMP3121 and COMP3131
Note/s: Not offered in 1997.

Parallelism and 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-Memory-Processor architecture. Object based systems; Languages with communication and processes; CSP, ADA, C; Locally and geographically distributed systems: Failure tolerant computer systems.

COMP9221
Microprocessor Systems
Staff Contact: Dr S. Matheson
CP15 S1 HPW4
Assumed knowledge: COMP9021, COMP9022
Note/s: Excluded 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 microprocessor-based systems.

COMP9231
Integrated Digital Systems
Staff Contact: Prof G. Hellestrand
CP15 S2 HPW4
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. *Lab:* design project.

COMP9242
Advanced Operating Systems
Staff Contact: Dr G. Heiser
CP15 S2 HPW4
Assumed knowledge: COMP9201/COMP9214
Note/s: Excluded COMP9416.

Covers operating systems in a breadth and depth that is significantly beyond the third year/level 2 OS subject. Focus will be on specific issues like performance as well as on the latest OS research areas. Topics selected from: Microkernels, user-level servers; object orientation; distributed systems: distributed process management, distributed file systems, naming, distributed shared memory, replication, coherency, naming; persistent systems; security; dealing with large, sparse address spaces; experimental systems. A laboratory running a state-of-the-art microkernal system will be used to provide hands-on experience with low-level implementation of OS components

COMP9311
Data Base Systems
Staff Contact: Prof J. Hiller
CP15 S1 or S2 HPW3
Assumed knowledge: Familiarity with storage structures.

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, hierarchical/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; object data bases; data definitions; application generators.

COMP9314
Next Generation Database Systems
Staff Contact: Dr A. Ngu
CP15 SS HPW3
Assumed knowledge: COMP9311

Detailed examination of current developments and future trends in database management systems and languages. The emphasis is on object-oriented database systems. Other topics are drawn from: deductive databases, temporal databases, multimedia databases, date warehousing, data mining, client/server systems, Web-based databases.

COMP9315
Database Systems Implementation
Staff Contact: Dr A. Ngu
CP15 SS HPW3
Assumed knowledge: COMP9311

Detailed examination of techniques used in the implementation of relational, object-oriented and distributed database systems. Topics are drawn from: query optimisation, , transaction management, advanced file access methods, database performance tuning.

COMP9331
Computer Networks and Applications
Staff Contact: Dr J. Zic
CP15 S1 HPW3
Assumed knowledge: COMP9024 or (COMP9020 and COMP9021)
Note/s: Excluded COMP3331.

Networking technology and protocol overview. *Local Area Networks:* architectures; media; generalised Medium Access Control methods. IEEE802 LAN standards. *Datalink layer:* design principles and protocols such as stop and wait, sliding windows, and Automatic Repeat Request schemes. *Network Layer:* design principles; addressing; message routing; congestion and traffic control. *Internetworking:* issues; bridges and routers. The Internet Protocol (IP) and the Internet. Internet Routing via exterior and interior router level protocols such as EGP, RIP, OPSF and HELO. Internet Transport Control Protocol (TCP). RPC and Session control. Network management using SNMP. The Domain Name System (DNS). Mail systems. File transfer protocols. Encryption and Security. A view to the future of networking.

COMP9414
Artificial Intelligence
Staff Contact: Dr C. Sammut
CP15 SS HPW4
Assumed knowledge: COMP9024 or (COMP9020 and COMP9021)

Overview of Artificial Intelligence. Topics include: the representation of knowledge, search techniques, problem solving, machine learning, expert systems, natural language understanding, computer vision and languages for Artificial Intelligence. Student may be required to submit simple Artificial Intelligence programs or essays on one aspect of A.I., for assessment, in areas such as robotics, vision, language understanding, speech recognition, A.I. languages, learning.

COMP9415
Computer Graphics
Staff Contact: Dr T. Lambert
CP15 SS HPW3
Assumed knowledge: Background to final year Computer Science level, 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 surface removal, lighting and texture maps. Hierarchical modelling of objects, modelling curves and surfaces with splines and fractals. Graphics standards. *Lab*: programming assignments.

COMP9416
Knowledge-Based Systems
Staff Contact: A/Prof P. Compton
CP15 SS HPW3
Pre-requisite: COMP9414

This subject introduces students to the basic concepts in knowledge-based systems and provides practical experience through project work. The topics covered include: knowledge representation and problem solving; knowledge acquisition and machine learning; knowledge level modelling, expert systems lifecycles and expert

system shells. A major component of this subject is a project in which students work in t3eams to build expert systems that act as agents in a competitive simulation game.

COMP9417
Machine Learning
Staff Contact: Dr A. Sharma
CP15 SS HPW3
Assumed Knowledge: COMP9414
Note/s: Excluded COMP4416.

Decision tree algorithms (such as C4.5), covering algorithms (such as AQ), instance based learning, case-based learning, nearest neighbour classifiers, genetic algorithms, inductive logic programming and theoretical analysis of learning algorithms.

COMP9444
Neural Networks
Staff Contact: Dr T. Gedeon
CP15 SS HPW3
Note/s: Excluded COMP4444.

Topics chosen from: Network architectures: perceptrons, Hopfield and Kohonen nets, ART models, back-propagation trained feed-forward networks, recurrent nets, weightless nets. Computational complexity analysis of training neural network architectures. Probabilistic analysis of generalisation capabilities of feed-forward networks. Hardware based neural nets. Introduction to fuzzy logic, neurotrained nets; designing successful applications of neural networks; tensor product networks; and recent developments in neural networks. The assessment will include a lab project related to application of neural nets.

COMP9511
Human-Computer Interaction
Staff Contact: Dr C. N. Quinn
CP15 S1 HPW3

Provides an introduction to user-system interactions, both analysis and design. The approach is cognitive, focusing on matching user goals with computer technologies. *The Topics:* the human information processing system, models of interaction, strategies for and process of design, and evaluation. Project work is emphasised.

COMP9514
Advanced Decision Theory for Information Science
Staff Contact: Dr A. Ramer
CP15 SS HPW3
Assumed Knowledge: A graduate level in expert systems 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.

COMP9517
Image Processing and Applications
Staff Contact: Dr J. Jin
CP15 SS HPW3
Assumed Knowledge: COMP9024 or (COMP9020 and COMP9021)
Note/s: Excluded COMP4012.

Fundamental principles for visual representation and image processing. Techniques in image transform, enhancement, compression and segmentation, feature extraction, pattern recognition, multimedia processing and authoring, and scientific visualisation. Applications in communications, consumer electronics, medicine, management, entertainment, defence, robotics, and geophysics.

COMP9518
Pattern Recognition and Vision
Staff Contact: Dr A. Sowmya/Dr A. Amin
CP15 SS HPW3
Prerequisite: COMP9517

Principles of pattern recognition and computer vision; review of early processing. Pattern Recognition: classification techniques; structural and syntactic pattern recognition; document image analysis and character recognition; statistical pattern recognition. Computer Vision: 2D and 3D representation; model-based vision and image understanding; motion analysis and active vision; applications in medical imaging, robot vision, satellite imaging, multimedia.

COMP9596
Advanced Topics In Information Science
Staff Contact: Prof J. Hiller
CP30 S1 or S2 HPW6

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.

COMP9912
Project Report
CP60

COMP9945
Project
Staff Contact: School Office
CP45 S1 or S2

A program of directed study or minor research under the supervision of an academic staff member. A comprehensive project report must be submitted within four weeks of the end of the session in which enrolment occurs.

SENG1010
Software Engineering Workshop 1A
Staff Contact: School office
S1 HPW 2.5 CP7.5
Prerequisites: HSC minimum mark required: 2 unit Contemporary English (60-100), or 2 unit General English (60-100) or 2 unit English (53-100) or 3 unit English (1-50).
Corequisites: COMP1011, INFS1603

The Software Engineering Workshop is a series of subjects that span the first three years of the Software Engineering course. The subject series will provide an opportunity to work in small teams on substantial, realistic projects,

covering most phases of the software production life cycle. The SE Workshop stream also provides an opportunity to apply the techniques and methods covered in other subjects of the course.

Under guidance from staff, the intention of this series is to enable students to learn by reflective practice. Whatever steps are taken students should become aware of what they are doing, and reflect on the consequences. This is the essence of the Personal Software Process described in the textbook by Watts Humphrey.

Each subject in the series will involve group project work, presentations, report writing, and documentation.

This is the first subject in the series and will contain: an introduction to the software process and to a number of the software engineering practices to be adopted throughout the series; the formation of the first set of small groups; a number of exercises to develop group skills; a discussion of the project to be undertaken in SENG1020.

The groups formed during this subject will not persist for the entire series of subjects. Groups will be reformed arbitrarily at various stages.

SENG1020
Software Engineering Workshop 1B
Staff Contact: School Office
S2 HPW 2.5 CP7.5
Prerequisites: SENG1010
Corequisites: INFS1611, COMP1021

See main entry SENG1010.

This is the second subject in the series and during this phase each group will complete a domain analysis and a requirements analysis for the project determined in SENG1010. Each group will: examine similar systems; interview users or potential users of the system; develop a requirements document; validate the requirements by prototyping. This subject will form the practical component of INFS1611.

SENG2010
Software Engineering Workshop 2A
Staff Contact: School office
S1 HPW 2.5 CP7.5
Prerequisites: SENG1020
Corequisites: INFS2603, COMP2110

See main entry SENG1010.

This is the third subject in the series and will cover specification. During this subject the groups will take a requirements document (not necessarily the same document developed by the current teams during SENG1020) and develop a logical specification document. The specification document must be developed using the modelling techniques discussed in INFS2603 and COMP2110. As part of the specification document, the groups should identify a set of acceptance tests appropriate to the functional specification

This subject forms the practical components of COMP2110.

SENG2020
Software Engineering Workshop 2B
Staff Contact: Mr K. Robinson
S2 HPW 2.5 CP7.5
Prerequisite: SENG2010

See main entry SENG1010.

In this subject, the fourth subject in the series, the groups will take a specification document, such as might have been produced in SENG2010, and will produce a design document describing how the specified system will be mapped onto physical components.

SENG3010
Software Engineering Workshop 3A
Staff Contact: School Office
S1 HPW 2.5 CP7.5
Prerequisite: SENG2020

See main entry SENG1010.

Each group will take a design document, such as might have been produced in SENG2020, and carry out the implementation and testing of the components of the system. As for all components of this series the implementation and testing will be documented.

SENG3020
Software Engineering Workshop 3B
Staff Contact: School Office
S2 HPW 2.5 CP7.5
Prerequisite: SENG3010

See main entry SENG1010.

In the sixth and final subject in the series, the groups will undertake the integration, testing, evaluation, and maintenance of a system, whose components have been produced in SENG2010.

SENG4811
Professional Issues and Ethics
Staff Contact: School Office
S1 HPW 4 CP15

This subject will develop a framework on which professional and ethical issues can be developed. Topics covered will include team and meeting skills, communication skills, interpersonal skills, software quality and process, in addition to ethics. The subject will be delivered using lectures, class discussions, written assignments, reading lists, the Internet, presentations, and invited speakers.

SENG4903
Industrial Training
Staff Contact: School Office

Students enrolled in course 3648 must complete a minimum of 60 days' industrial training. At least some of this should be obtained in Australia. 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.

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.

SENG4910
Thesis Part A
Staff Contact: School Office
SS HPW 7 CP15

See main entry for SENG4911.

This subject represents the thesis proposal component. The proposal is assessed by a seminar given at the end of session.

SENG4911
Thesis Part B
Staff Contact: School Office
SS HPW 14 CP30
Prerequisite: SENG4910

The thesis 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 of the Schools of Computer Science and Information Systems. Generally, the thesis involves the design, construction, and testing of a software application, but the thesis could be an exploration and evaluation of some aspects of a software development method. Each student is required to demonstrate the outcome of the thesis work, and present a written thesis at the end of the second session.

School of Electrical Engineering

Head of School
Professor G. A. Rigby

Executive Assistant to Head of School
Dr T. Hesketh

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 **Photovoltaics Special Research Centre** conducts research into energy efficient silicon solar cells for electricity generation.

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

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

Summary of Undergraduate Courses

Normal full-time

Course and Degree(s)	Duration
3640 BE in Electrical Engineering	4 years
3645 BE in Computer Engineering	4 years
3720 BE BA in Electrical Engineering	5 years
3725 BE BSc in Electrical Engineering	5 years
3727 BE MBiomedE in Electrical Engineering	5 years

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.

In a new initiative with the Graduate School of Biomedical Engineering there is also available a concurrent degree program leading to the award of Bachelor of Engineering/Master of Biomedical Engineering.

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.**

Substitution of 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

Computing Requirements

Information regarding recommended computing equipment for the courses offered by the School is available from the School Office.

Course Outlines

3640
Electrical Engineering - Full-time Course
Bachelor of Engineering
BE

Course 3640 has been revised and is shown below.

		HPW S1	HPW S2	CP
Year 1				
CHEM1806	Chemistry 1EE	3	0	**7.5**
COMP1011	Computing 1A	0	6	**15**
ELEC1010	Introduction to Electrical Engineering	1.5	0	**4**
ELEC1011	Electrical Engineering 1	6	0	**15**
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	**15**
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	**15**
MATH1090	Discrete Mathematics	0	3	**7.5**
ELEC1041	Digital Circuits	0	3	**7.5**
PHYS1969	Physics 1	6	6	**30**

Total HPW Session 1 22.5
Total HPW Session 2 24
Total Credit Points 116.5

		HPW S1	HPW S2	CP
Year 2				
COMP1021	Computing 1B	6	0	**15**
ELEC2011	System Theory	0	2.5	**6.5**
ELEC2015	Electromagnetic Applications	0	2.5	**6.5**
ELEC2030	Circuit Theory	3.5	0	**9**
ELEC2033	Electronics 1	0	4	**10**
ELEC2041	Microprocesses and Interfacing	4	0	**10**
ELEC2042	Real Time Instrumentation	0	4	**10**
MATH2011	Several Variable Calculus	4	0	**15**
MATH2620	Higher Complex Analysis	0	2.5	**7.5**
MATH2849	Statistics EE	0	3	**9**
MATH3150	Transform Methods	0	2	**7.5**
PHYS2949	Physics 2E	6	0	**15**
General Education subject/s		0	4	**15**

Total HPW Session 1 23.5
Total HPW Session 2 24.5
Total Credit Points 136

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

		HPW S1	HPW S2	CP
Year 3				
ELEC3004	Signal Processing 1	4	0	**10**
ELEC3005	Electrical Energy 1	4	0	**10**
ELEC3006	Electronics 2	5	0	**12.5**
ELEC3013	Communication Systems 1	0	4	**10**
ELEC3014	Systems and Control 1	0	4	**10**
ELEC3017	Electrical Engineering Design	0	5	**12.5**
MATH2501	Linear Algebra	5	0	**12.5**
General Education subject/s		0	4	**15**

Two subjects must be taken from Groups A and B below, with a maximum of one subject from Group B. Additional subjects may be taken from Group A in Year 4 as substitutions for Year 4 Professional Electives:

Group A		HPW S1	HPW S2	CP
ELEC3015	Electrical Energy 2	0	4	**10**
ELEC3016	Electronics 3	0	4	**10**
ELEC3041	Real Time Engineering	4	0	**10**
MATH3141	Mathematical Methods EE	0	4	**10**
Group B (Technical elective)				
COMP2011	Data Organisation	0	5	**15**
ELEC3402	Introductory Physiology for Engineers	4	0	**10**
PHYS2999	Mechanics and Thermal Physics	2	2	10
ACCT9062	Accounting for Engineers	1.5	1.5	**10**

Total HPW Session 1 **22**
Total HPW Session 2 **21**
Total Credit Points **112.5**

Notes:

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

2. Core subjects MATH2501 and General Education may be taken in either session or spread over a full year as required to balance the Year 3 program.

Year 4

5 Professional Electives		12	8	**60**
ELEC4010	Introduction to Management for Electrical Engineers (Gen. Ed.)	4	0	**12**
ELEC4011	Ethics and Electrical Engineering Practice (Gen.Ed.)	0	2	**6**
ELEC4903	Industrial Training	0	0	**0**
ELEC4910	Thesis Part A	5	0	**15**
ELEC4911	Thesis Part B	0	10	**30**

Total HPW Session 1 **21**
Total HPW Session 2 **20**
Total Credit Points **123**

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.

3645
Computer Engineering - Full-time course

Bachelor of Engineering
BE

This course 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.

Electrical Engineering Professional Electives - all courses

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

		CP
ELEC4042	Signal Processing 2	12
ELEC4205	Electrical Energy Systems	12
ELEC4216	Electrical Drive Systems	12
ELEC4240	Power Electronics	12
ELEC4313	Optical Communications	12
ELEC4333	Communication Systems 2	12
ELEC4351	Data Networks 1	12
ELEC4352	Data Networks 2	12
ELEC4412	Systems and Control 2	12
ELEC4413	Systems and Control 3	12
ELEC4483	Biomedical Instrumentation, Measurement and Design	12
ELEC4503	Electronics 4	12
ELEC4512	Semiconductor Devices	12
ELEC4522	Microelectronics Design and Technology	12
ELEC4532	Integrated Digital Systems	12
ELEC4540	Applied Photovoltaics	12
COMP3211	Computer Organisation and Design	15
COMP3231	Operating Systems	15
COMP3311	Database Systems	15
COMP3411	Artificial Intelligence	15
MATH3411	Information, Codes and Ciphers	15

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.

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.

Organisation

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 in Year 2. 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) 120 credit points total, including major sequence

Other Faculties:
Major sequence plus at least 30 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. There will be a testamur for each part of the combined degree course.

3. Testamurs for the separate BE and BA programs will be awarded at a single graduation ceremony.

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 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 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 PHYS2999) 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 specialise in Computer Science, Mathematics or Physics in a BE/BSc degree course should consult the School before enrolling in Year 2.

Year 1 Standard program for course 3640
CHEM1806, COMP1011,
ELEC1010, ELEC1011, ELEC1041
MATH1131 or MATH1141,
MATH1231 or MATH1241,
MATH1090,
PHYS1969

Year 2
COMP1021,
ELEC2011, ELEC2015, ELEC2030, ELEC2033, ELEC2041, ELEC2042,
MATH2011, MATH2620, MATH2849, MATH3150,
PHYS2949

Computer Science majors add COMP2011 (as a Year 3 Group B subject) 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
ELEC3004, ELEC3005, ELEC3006, ELEC3013, ELEC3014, ELEC3017,
MATH2601, MATH3141

Two subjects from Groups A and B, with a maximum of one subject from Group B.
Group A: ELEC3015, ELEC3016, ELEC3041, MATH3141
Group B: ACCT9062, COMP2011, ELEC3402, PHYS2999,
General Education Subject/s

Computer Science majors must take COMP2031 (Towards their Science). The Higher Mathematics subject MATH2601 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 or PHYS3210, PHYS3030 or PHYS3230. (PHYS2999 is the 8th unit).

Year 5
Year 4 of the Electrical Engineering course.

3727
Electrical Engineering/Biomedical Engineering - Full-time Course

Bachelor of Engineering Master of Biomedical Engineering
BE MBiomedE

Course 3727 is a concurrent BE in Electrical Engineering and Master of Biomedical Engineering. Further details can be found in the Graduate School of Biomedical Engineering section.

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 Engineering

MEngSc

Candidates may commence in Session 1 or Session 2 and must possess an appropriate level of knowledge for the program subjects chosen.

All candidates elect to study in at least one of the specific programs offered by the School of Electrical Engineering: each Program Co-ordinator will advise if applicants are adequately qualified to undertake the proposed subjects and must approve the chosen program.

All candidates must register in one of the following major areas and in at least one of its programs:

Major Area
Communications

Program Co-ordinator: Dr H. Mehrpour
Programs:
1. Communication Electronics
2. Digital Communication and Systems
3. Microwave and Optical Communications
4. Signal Processing

Electric Power

Program Co-ordinator: A/Prof T.R. Blackburn
Programs:
1. Power Systems Engineering
2. Electrical Power Technology
3. Electrical Energy Systems

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)

Master of Engineering Science (for all new students)

Programs as listed normally consist of 72 credit points of course work and correspondingly a 48 credit point 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 120 credit points by course work only.

Specialist Programs

Communications

Candidates must normally do 72 credit points from the Communications area (a 48 credit point project and 24 credit points of coursework or 72 credit points of coursework within one of the following programs).

1. Communication Electronics
One elective subject may be chosen from outside this program.

Core subject		**CP**
ELEC9340	Communication Electronics	12
Elective subjects		
COMP9215	VLSI System Architecture and Design	15
COMP9221	Microprocessor Systems	15
ELEC9338	Television and Video Signal Processing	12
ELEC9341	Signal Processing 1 - Fundamental Methods	12
ELEC9343	Principles of Digital Communications	12
ELEC9353	Microwave Circuits: Theory and Techniques	12
ELEC9354	Microwave and Optical Devices	12
ELEC9403	Real Time Computing and Control	12
ELEC9503	Integrated Circuit Design	12

2. Digital Communication and Systems
Core subjects are at least three subjects taken from the following list and the remaining subjects from within the Department and School.

ELEC9336	Digital Communication Networks	12
ELEC9337	Data Networks	12
ELEC9338	Television and Video Signal Processing	12
ELEC9343	Principles of Digital Communications	12
ELEC9347	Digital Modulation	12

3. Microwave and Optical Communications
One of the three elective subjects may be chosen from outside this program.

Core subjects		CP
ELEC9350	Theory of Optical Fibres and Optical Signal Processing	12
ELEC9351	Propagation and Transmission of Electromagnetic Waves	12
ELEC9354	Microwave and Optical Devices	12
Elective subjects		
ELEC9352	Antenna Design and Applications	12
ELEC9353	Microwave Circuits: Theory and Techniques	12
ELEC9355	Optical Communications Systems	12

4. Signal Processing

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

Core subjects		
ELEC9341	Signal Processing 1 - Fundamental Methods	12
ELEC9342	Signal Processing 2 - Advanced Techniques	12
Elective subjects		
ELEC9340	Communication Electronics	12
ELEC9343	Principles of Digital Communications	12
ELEC9350	Theory of Optical Fibres and Optical Signal Processing	12
ELEC9370	Digital Image Processing Systems	12
ELEC9338	Television and Video Signal Processing	12

Electric Power

Normally 72 credit points of coursework and a 48 credit point project as appropriate. A program in another area offered by the School may be substituted for the project.

At least three subjects should be chosen from one of the three programs below, with the remainder from the other programs or from the list of relevant subjects in 4.

1. Power Systems Engineering

ELEC4202	Power Engineering 1	12
ELEC4215	Industrial Electrical Systems	12
ELEC9201	Power System Planning and Economics	12
ELEC9202	Power Systems Operation and Control	12
ELEC9203	Power System Analysis	12
ELEC9204	Protection of Power Apparatus and Systems	12
ELEC9223	Power Engineering Seminars	12

2. Electrical Power Technology

ELEC4202	Power Engineering 1	12
ELEC4215	Industrial Electrical Systems	12
ELEC9204	Protection of Power Apparatus and Systems 12	
ELEC9214	Power System Equipment	12
ELEC9231	Electrical Drive Systems	12
ELEC9223	Power Engineering Seminars	12
ELEC9226	Electrical Services in Buildings	12

3. Electrical Energy Systems

		CP
COMP9221	Microprocessor Systems	15
ELEC9201	Power System Planning and Economics	12
ELEC9202	Power System Operation, Control and Planning	12
ELEC9223	Power Engineering Seminars	12
ELEC9226	Electrical Services in Buildings	12
ELEC9504	Solar Energy Conversion	12
ELEC9507	Solar Cells and Systems	12
ELEC9221	Special Topic in Power	12

4. Relevant Subjects from other areas and disciplines

Relevant coursework subjects from other areas and disciplines are listed below. A limited number of credit points from this group may be taken as part of an Electric Power program. Subject to the approval of the Postgraduate Adviser, 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	10
COMP9221	Microprocessor Systems	15
ELEC4240	Power Electronics	12
ELEC9341	Signal Processing 1 - Fundamental Methods	12
ELEC9401	Computer Control Systems 1	12
MANF9400	Industrial Management	12
MECH9720	Solar Energy	12
MECH9741	Energy Conversion and Systems Design	12
SAFE9213	Introduction to Safety Engineering (M)	12

Electronics

Normally 72 credit points of coursework and a 48 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.

1. Solid State Devices

ELEC9354	Microwave and Optical Devices	12
ELEC9501	Advanced Semiconductor Devices	12
ELEC9502	Integrated Circuit Technology	12
ELEC9504	Solar Energy Conversion	12
ELEC9507	Solar Cells and Systems	12
ELEC9509	Photovoltaics	12

2. Microelectronics

COMP9215	VLSI Systems Architecture Design	15
ELEC9340	Communication Electronics	12
ELEC9501	Advanced Semiconductor Devices	12
ELEC9502	Integrated Circuit Technology	12
ELEC9503	Integrated Circuit Design	12

Additional elective subjects for programs 1 and 2:		CP
COMP9221	Microprocessor Systems	15
ELEC4240	Power Electronics	12
ELEC4532	Integrated Digital Systems	12
ELEC9341	Signal Processing 1 - Fundamental Methods	12
ELEC9342	Signal Processing 2 - Advanced Techniques	12
ELEC9343	Principles of Digital Communications	12
ELEC9353	Microwave Circuits: Theory and Techniques	12

3. Photovoltaics

ELEC9501	Advanced Semiconductor Devices	12
ELEC9502	Integrated Circuit Technology	12
ELEC9504	Solar Energy Conversion	12
ELEC9507	Solar Cells and Systems	12
ELEC9508	High Efficiency Silicon Solar Cells	12
ELEC9509	Photovoltaics	12

Additional electives for program 3

COMP9221	Microprocessor Systems	15
ELEC4202	Power Systems	12
ELEC4240	Power Electronics	12
ELEC9201	Power System Planning and Economics	12
ELEC9202	Power System Operation, Control and Planning	12
MECH9720	Solar Thermal Energy Design	12
MECH9741	Energy Conservation and System Design	12
SAFE9213	Introduction to Safety Engineering	12

Systems and Control

1. Digital Systems and Control

All coursework or 72 credit points of course work and a 48 credit point project. 48 credit point projects are subject to the availability of a suitable supervisor.

Core subjects

ELEC9401	Computer Control Systems 1	12
ELEC9402	Computer Control Systems 2	12
ELEC9403	Real Time Computing and Control	12
ELEC9404	Topics in Digital Control	12

Elective subjects

COMP9221	Microprocessor Systems	15
ELEC9342	Signal Processing 2 - Advanced Techniques	12
ELEC9405	Advanced Control Topics	12
ELEC9410	Robotics, Automation and Productivity Technology	12
ELEC9415	Optimization and Optimal Control	12
ELEC9416	Non-Linear Systems and Simulation	12

2. Cybernetic Engineering and Advanced Robotics

Normally 36 credit points of course work and a 48 credit point project.

Remaining 36 credit points may be taken from the elective list or other programs and subjects.

Core subjects

ELEC9407	Cybernetic Engineering	12
ELEC9409	Cybernetic, Machine and Robot Vision	12
ELEC9410	Robotics, Automation and Productivity Technology	12

Elective subjects

		CP
COMP9221	Microprocessor Systems	15
ELEC9342	Signal Processing 2 - Advanced Techniques	12
ELEC9370	Digital Image Processing Systems	12
ELEC9403	Real Time Computing and Control	12
ELEC9405	Human Movement Control Systems	12

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 (typically 6 courses at 8 credit points each)	48
Project	ELEC9912 Project Report	48
Total:		**96**

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 32 credit points, 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 on 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. Not all electives are necessarily offered in any particular year.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organisational 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.

ELEC0807
Electrical Engineering 1E
Staff Contact: Dr B.D. Farah
CP7.5 S2 L2 T1
Prerequisite: PHYS1002, PHYS1919 or equivalent

Fundamental concepts in electrical circuits: key theorems, analysis of AC circuits, complex impedance, RLC circuits. Introduction to amplifiers and filters. Functional circuits based on operational amplifiers. Introduction to digital logic, based on integrated circuits. Combinational logic and memory., Electric machines: DC and AC motors. Characteristics of principle types and their applications.

ELEC0808
Electrical Engineering 2E
Staff Contact: Dr B.D. Farah
CP7.5 S2 L2 T1
Prerequisite: ELEC0807

Signal processing using integrated operational amplifiers, passive components and selected non-linear elements. Processing data from typical industrial sensors. Digital logic: registers, adders. Serial and parallel data transmission. A/D converters. The architecture of a microprocessor and an outline of programmed control. Transformers and power supplies. Dynamic characteristics of AC and DC motors. Speed control and principles of servo design.

ELEC0931
Industrial Elective
CP10

ELEC0932
Industrial Elective
CP10

ELEC0933
Industrial Elective
CP12
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
CP4 S1 L1 T.5
Prerequisite: HSC mark range required - 2 unit English (General) 60-100,or 2 unit English 53-100, 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. organisation, verbal and written communication and research skills in engineering.

ELEC1011
Electrical Engineering 1
Staff Contact: Dr E.H. Fooks
CP15 S1 or 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. Average and r.m.s. values. Circuit models of diodes and transistors. Combinational logic principles and circuits.

ELEC1041
Digital Circuits
Staff Contact: Dr W.J. Dewar
CP7.5 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. Algorithmic state machines: systematic design procedures, register transfer notation, bus systems. Design applications: multipliers, dividers, control units.

ELEC2011
Systems Theory
Staff Contact: Dr D.J. Clements
CP6.5 S2 L2 T1
Prerequisites: ELEC2030, MATH2011 or 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.

ELEC2015
Electromagnetic Applications
Staff Contact: A/Prof F. Rahman
CP6.5 S2 L2 T.5
Prerequisites: PHYS2949
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.

ELEC2030
Circuit Theory
Staff Contact: Dr K.C. Daly
CP9 S1 L2 T1.5
Prerequisites: ELEC1011, MATH1032 or MATH1231 or MATH1042 or MATH1241
Corequisite: MATH2620 or MATH2520
Note/s: Excluded ELEC2010.

Dynamic response of linear circuits: 1st and 2nd order circuits with DC sources, introduction to higher order circuits. Sinusoidal steady state operation: phasers, impedance and admittance; dynamic response of circuits driven by sinusoidal sources: linearity, network theorems; resonance, bandwidth, and quality factor. Two-port network: parameters, circuits as filters. Power in steady-state circuits; average and reactive power, power factor, power factor correction. Operational amplifiers and ideal transformers. The use of a computer aided circuit analysis package. Laboratory technique.

ELEC2033
Electronics 1
Staff Contact: A/Prof S.R. Wenham
CP10 S2 L2 T2
Prerequisites: ELEC2030
Note/s: Excluded ELEC2020.

Operating principles and terminal characteristics of PN diodes, solar cells, bipolar and field effect transitors, and thyristors. Analysis and design of low-frequency single stage and multistage class A amplifiers, including choice of biasing method. Consideration is given to stability, feedback, impedance matching, gain, frequency response, output voltage swing and the various accompanying trade-offs. The operation of differential and operational amplifiers is studied, with circuits based on the use of operational amplifiers used to study feedback and amplification.

ELEC2041
Microprocessors and Interfacing
Staff Contact: Dr W.S. Matheson
CP10 S1 L2 T2
Prerequisites: COMP1011, ELEC1041
Co-requisite: COMP1021
Note/s: Excluded ELEC3020, COMP3221, COMP9221.

The programmer's model of a microprocessor: writing assembly language programs. The hardware model of a microprocessor: synchronous and asynchronous busses. Interfacing concepts: I/O Organisation, address decoding, static and dynamic memory interfacing. Direct I/O for simple peripherals. I/O support devices: PIAs, ACIAS. Interrupt-driven I/O: interrupt vectors, interrupt handlers, DMA controllers. Standard microcomputer busses: VME, EISA, SCSI and others. Laboratory interfacing experiments using 8-bit and 16-bit hardware, assembly language software, real-time kernels and operating systems.

ELEC2042
Real Time Instrumentation
Staff Contact: Dr T. Hesketh
CP10 S2 L2 T2
Prerequisites: ELEC1041, ELEC2041

Object oriented programming: structured programming, data abstraction, classes, overloading, inheritance, polymorphism, C++. Hardware requirements for real time applications: systems model of the computer, process-related interfaces (digital, analog, clocks), scaling, data transfer (polling, interrupts, DMA), serial data transmission, multi-plexing, bus systems, instrumentation bus. Software development: real-time specification standards. Real time specification and design: state machines, specification techniques. Simple real time kernels: state machine multi-tasking, co-routines,

interrupts, foreground/background systems. Engineering applications: systems model of instrumentation data communication network protocols.

ELEC3004
Signal Processing 1
Staff Contact: Dr T. Hesketh
CP10 S1 L2 T2
Prerequisites: ELEC2011, MATH2849, MATH3150
Note/s: Excluded ELEC3012, ELEC3032.

Assumed knowledge: Fourier analysis, Laplace transforms, z-transforms and linear system theory. Processing and analysis of continuous (analog) and discrete (digital) signals. Analog filters; approximation theory, Butterworth, Bessel, Chebyshev and elliptic filters. Examples of realizations of analog filters using operational amplifiers. Filter stability and sensitivity. Sampling continuous signals; sampling theorem, signal reconstruction and aliasing errors. The discrete Fourier transform (DFT) and fast Fourier transform (FFT) alogrithms. Fundamentals of the design and realization of finite impulse response (FIR) and infinite impulse response (IIR) digital filters. Digital processing of analog signals, including implementations on programmable digital signal processing (DSP) chips. The representation and modelling of random signals, correlation functions and power density spectra.

ELEC3005
Electric Energy 1
Staff Contact: A/Prof C. Grantham
CP10 S1 L2 T2
Prerequisite: ELEC2015
Note/s: Excluded ELEC3010.

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

ELEC3006
Electronics 2
Staff Contact: Dr C. Honsberg
CP12.5 S1 L3 T2
Prerequisite: ELEC2033
Note/s: Excluded ELEC3011, ELEC3031, ELEC3006, ELEC3016

Frequency analysis of amplifiers. Design and analysis of feedback amplifiers. Amplifier stability analysis. Comparators. Schmidt triggers. Waveform generators: sinusoidal, square, triangular. Waveform shaping circuits. Multiplier. A-D and D-A converters.

ELEC3013
Communication Systems 1
Staff Contact: Mr G. Kbar, Dr C. Phillips
CP10 S2 L2 T2
Prerequisite: ELEC3012 or ELEC3032 or ELEC3004

Overview of information acquisition, transmission and processing. Aims to enable students not specialising in this field to understand the communication problems they are likely to meet in their career, and to provide a background if they intend to specialise in communications. Topics 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, telephone systems, modems, networks, repeaters, equalisers, line coding).

ELEC3014
Systems and Control 1
Staff Contact: A/Prof P.D. Neilson
CP10 S2 L2 T2
Prerequisite: ELEC3012 or ELEC3032 or ELEC3004

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 2
Staff Contact: A/Prof C. Grantham
CP10 S2 L2 T2
Prerequisite: ELEC3005

Basic aspects of both the supply and utilization of electrical energy, with some emphasis on contemporary aspects of energy utilization, including modern developments, energy efficiency and environmental aspects.

Electrical energy supply systems: transmission and distribution systems, power transfer, reactive power effects, fault current calculation and protection. Quality of electricity supply; transient overvoltages, harmonics etc. and their ramifications in the operation of electrical power equipment. Electromagnetic compatibility (EMC).

Utilization of electrical energy: industrial application considerations, including DC machines, induction and synchronous motor drives. Computer-aided analysis of machines. Use of modern techniques of Power Electronics for application to variable speed drive systems, including DC-AC, DC-DC and AC-AC converters.

Utilization of electrical energy for lighting and industrial heating processes including discharge, induction and RF heating. Electrical safety of power equipment: equipment requirements for use in hazardous atmospheres; earthing and earth leakage protection.

ELEC3016
Electronics 3
Staff Contact: Dr C.Y.Kwok
CP10 S2 L2 T2
Prerequisite: ELEC3006
Note/s: Excluded ELEC4512, ELEC9501

Operating principles and fabrication technologies of devices used in electronic circuits and the resulting impact on circuit operation and design. Devices covered include pn junctions, BJTs & MOSFETs in analogue and integrated circuits (TTL, ECL, CMOS etc) LEDs, lasers and optical waveguides as used in communication systems and microwave devices.

ELEC3017
Electrical Engineering Desig
Staff Contact: A/Prof W.H. Holmes
CP12.5 S2 L2 T3
Prerequisite: ELEC2042, ELEC3006
Note/s: Excluded ELEC2016.

Electrical product design in a manufacturing environment, from original idea through technical specifications, prototype, manufacture and finally to marketing. In particular:

Design Project Management: Introduction to scheduling and other management techniques. Also introductions to costing, pricing, marketing, standards, patents, quality and reliability, safety, (electronic) manufacturing methods and systems, engineering innovation.

Design Methodology: Systematic design procedures, design documentation. Designing for quality, for manufacture, for maintenance, for minimum life cycle cost. Use of computer aids for project management, drawing, PCB design, circuit analysis and synthesis, documentation, etc.

Engineering Drawing and Graphical Communications: Standards, projections, dimensioning, tolerancing, drawing interpretation, use of CAD tools.

Report Writing and Oral Presentations

Aspects of Electronic Design: Device specifications, component choices, sourcing, data sheets, tolerances, aging, thermal dissipation, passive component characteristics. Also RFI and EMC, earthing, shielding, PCB layout principles, prototyping methods, interconnection technologies.

Group Project: including specification, marketing and business plans, scheduling, design, prototype production, testing, formal technical report and seminar presentation.

ELEC3041
Real Time Engineering
Staff Contact: Dr T. Hesketh
CP10 S1 L2 T2
Prerequisite: ELEC2042

Real-Time Specification and Design: program specification methods; state-based discrete event specification; Petri nets; timing analysis; simulation techniques.

Real-Time Kernels: Co-routines and multi-tasking; queueing models and realisations; pre-emptive scheduling; scheduling algorithms; intertask communication and synchronisation; event-driven systems; real-time memory management; system performance, analysis and optimisation; reliability, testing and fault tolerance; multiprocessing systems.

Control System Realization: controller structures; implementation of continuous and discrete controllers; robustness issues; programmable logic controllers.

Networks; coding; serial data transmission; modems, layered protocols; standards; simple LANs.

ELEC3110
Electrical Engineering Laboratory 3
Staff Contact: Dr R. Radzyner
CP15 S1 T6
Prerequisite: ELEC2016
Corequisites: ELEC3020, ELEC3010, ELEC3011, ELEC3012

A program 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
CP2.5 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
CP5 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
CP2.5 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
CP5 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
CP10 S2 L2 T2
Prerequisite: MATH2849 attempted
Corequisite: MATH2859 or MATH2849
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
CP10 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
CP10 S1 L3 T1

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
CP5 S2 L1 T1
Prerequisite: ELEC4010

An introduction to the nature and origins of ethical systems; the application of ethical bases to engineering practice with particular reference to electrical engineering and computing; codes of ethics in the professions, with special reference to the Code of Ethics of the Institution of Engineers, Australia; social, political, environmental and economic considerations.

ELEC4042
Signal Processing 2
Staff Contact: Dr C.J.E. Phillips
CP12 S1 L2 T3
Prerequisite: ELEC3004, MATH3150

Design of digital filters and their implementation in software and in hardware using special purpose digital signal processors (DSP chips). Fourier analysis of continuous and discrete time signals using the discrete Fourier transform (DFT). Fast Fourier transform (FFT) algorithms. Multirate digital signal processing. Least square filter design and the detection and estimation of signals in noise. Wiener filters, linear prediction and the Levinson algorithm, AR and ARMA modelling. Adaptive signal processing. Adaptive digital filters and the least mean-square (LMS) and recursive least squares (RLS) algorithms. Applications to system identification, modelling, noise and interference cancelling and inverse filtering. Nonstationary signal processing and analysis using the short-time Fourier transform and the wavelet transform. Power spectrum estimation.

ELEC4205
Electrical Energy Systems
Staff Contact: A/Prof T.R. Blackburn
CP12 S1 L2 T2
Prerequisite: ELEC3005

Review of the basic concepts used in power system analysis: phasers, complex power, three phase systems and per-unit methodology. Modelling of power system components, including transformers and synchronous machines. Aspects of power system operation, including power flow, reactive power control and fault analysis. Harmonics and their effects. Choice and use of protective equipment, including fuses, circuit breakers, relays and surge arresters. Equipment rating for operation in steady state and cyclic modes. Insulation system design and practical limitations. High voltage equipment testing methods and their use in insulation condition monitoring of electrical energy systems. Quality of supply. The impact of EMC and EMI requirements on electrical energy systems.

ELEC4216
Electrical Drive Systems
Staff Contact: A/Prof C. Grantham
CP12 S2 L2 T2
Prerequisite: ELEC3005

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. The analysis of asymmetrically connected induction motors. Unified machine theory. Computer aided design.

ELEC4240
Power Electronics
Staff Contact: Dr K.C. Daly
CP12 S1 L2 T2
Prerequisite: ELEC3005

This subject 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 subject 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.

ELEC4313
Optical Communications
Staff Contact: A/Prof P.L. Chu
CP12 S1 L2 T2
Pre-requisites: ELEC3013, MATH3141
Note/s: ELEC2015 recommended.

Light propagation in multimode and single mode optical fibres, Fibre measurements, Fibre manufacture, Fibre imperfection, Power-budget and Dispersion-budget system design. Photodiodes and photodetectors.

ELEC4333
Communications Systems 2
Staff Contact: A/Prof T.B. Vu
CP12 S2 L2 T2
Prerequisites: ELEC3006, ELEC3013

Modern communications systems from a systems point of view. Mobile communications systems: evolution of mobile communications, cellular mobile communications fundamentals, design parameters, analog versus digital systems. Satellite communications systems: satellite orbits and launching techniques, satellite channel, link analysis, access techniques including FDMA, TDMA and CDMA. Video communications systems: analog video communications techniques, analog video signals and standards, digital video systems, digital video processing, analog versus digital techniques.

ELEC4351
Data Networks 1
Staff Contact: Mr G. Kbar
CP12 S1 L2 T2
Prerequisites: ELEC2041 or COMP3221, ELEC3013

Computer communication architecture. A communications model. Data Communications. Transmission media. Error detection coding and synchronisation. Physical layer standards and modems. IEEE-488 instrument bus. Principles of data networks and introduction to 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, Media Access Control (MAC) layer and network layer protocols in a practical network.

ELEC4352
Data Networks 2
Staff Contact: Dr H. Mehrpour
CP12 S2 L2 T2
Prerequisite: ELEC4351

Performance measurement and analysis of data link, network and transport protocols. Routing algorithms, congestion control techniques, traffic shaping and policing, internetworking-bridges, gateways and routers. High speed local area networks. Internet network and transport protocols. Operating system views of communications; network protocol drivers, network servers. Network security. World wide web, HTML. Asynchronous Transfer Mode (ATM) protocols. ATM Adaptation Layer protocols. ATM switching techniques. Laboratory work covers implementations of queues and pipes in media access up to application layer protocols on a UNIX based OS-9 operating system platform.

ELEC4412
Systems and Control 2
Staff Contact: Prof N.W. Rees
CP12 S1 L2 T2
Prerequisite: ELEC3014

This subject discusses the analysis and design of control systems, building on the classical methods taught in Year 3. The theoretical basis for both continuous and discrete systems is developed. The course covers: process modelling by physical analysis; experimental methods and system identification; classical PID control and discrete PID implementation; discrete and continuous state-space theory; controllability; observability; solution of state equations; modern frequency response methods; robustness; state variable feedback controller design; pole placement and optimal controller design methods; observers.

ELEC4413
Systems and Control 3
Staff Contact: Dr D.J. Clements
CP12 S2 L2 T2
Prerequisite: ELEC4412
Note/s: ELEC3041 recommended.

Covers the design of practical control systems intended for implementation using digital computers and embedded systems. Controllers may be developed using both continuous and discrete designs. The topics covered include: identification of model parameters; noise models and stochastic systems; numerical integration and implementation of continuous designs; observers and Kalman filtering; LQG control; norms for signals and systems; robustness; simple loop shaping; performance/robustness trade-offs; internal models and model following; introduction to ideas of adaptive control. Aspects of implementation are constantly emphasized.

ELEC4483
Biomedical Instrumentation, Measurement and Design
Staff Contact: A/Prof B.G. Celler
CP12 S2 L2 T2
Prerequisites: ELEC3004
Note/s: ELEC3402 recommended.

Design oriented approach to biomedical measurement and instrumentation. Properties of biopotentials and other biological signals. Transducers, electrodes and biopotential amplifiers. Common mode rejection and body potential driving. Noise and performance characteristics of very low noise instrumentation amplifiers. Morphological and spectral properties of biomedical signals. Signal processing and filtering. Review of clinical measurement apparatus including pressure, flow and imaging instruments. International standards for safety and performance of medical instruments. The PC buss. Interfacing instruments to the PC. GPIB and VXI instrumentation busses.

ELEC4503
Electronics 4
Staff Contact: Prof G.A. Rigby
CP12 S1 L2 T2
Prerequisite: ELEC3016

Advanced analog circuit techniques for signal processing and interfacing. Basic active filters characteristics and

design techniques. Realisation of active filters: continuous time RC and op amp circuits. Switched capacitor filters. Analog multipliers and their application in modulation, demodulation, gain control and phase comparison. The phase-locked loop: VCO design, lock and capture processes. Applications. Power amplifiers; class A, class B, efficiency and linearity.

ELEC4512
Semiconductor Devices
Staff Contact: Dr C. Honsberg
CP12 SS L2 T2
Prerequisite: ELEC3011

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

ELEC4522
Microelectronics Design and Technology
Staff Contact: Dr C.Y. Kwok
CP12 S2 L2 T2
Prerequisite: ELEC3016

Review of technology for bipolar and MOS integrated circuits. Device models, layout rules. Analog circuit building blocks. Bipolar and CMOS operational amplifiers. CMOS logic. MOS Analog-Digital and Digital-Analog converters. Memory - DRAM/SRMA. Yield, reliability and failure analysis techniques. 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
CP12 SS L2 T2
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: A/Prof S.R. Wenham
CP12 S1 L2 T2

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 C.J.E. Phillips

Students enrolled in courses 3640, 3720, 3725 and 3727 are required to complete a minimum of 60 days industrial training with one or more companies before graduation and preferably before the commencement of Year/Stage 4. The objectives of industrial training are i) to develop an appreciation of the structure and operation of industrial organizations, ii) to understand the rôle of the engineer and engineering in industry and iii) to appreciate the importance of good communication and interpersonal skills and to develop these skills. Students are required to submit to the School evidence from their employers for each period of training confirming the industrial training together with a report. The report, typically 2000 to 3000 words long, should summarize the actual technical work carried out and include a brief description of the company and its organization and operation. It is preferred that some industrial training should be obtained in Australia. When the industrial training is done overseas, the report should include a more detailed description of the company concerned. Experience claimed as an Industrial Elective covers requirements for this subject.

Students are formally enrolled in this subject as part of their Year/Stage 4 program.

ELEC4910
Thesis Part A
Staff Contact: Dr C.J.E. Phillips
CP15 S1 HPW6
Corequisite: ELEC3017 from Session 2, 1997.

ELEC4911
Thesis Part B
Staff Contact: Dr C.J.E. Phillips
CP30 S2 HPW12
Prerequisite: ELEC4910

The Thesis Project is carried out 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 as part of the requirements for ELEC4910, Thesis Part A. Satisfactory performance in subject ELEC4910 is a prerequisite for progress to subject ELEC4911. A written thesis report must be submitted on each project by the Tuesday of the 14th week of the second session of enrolment to satisfy the requirements for ELEC4911, Thesis Part B.

ELEC9201
Power System Planning and Economics
Staff Contact: A/Prof H.R. Outhred and Dr R.J. Kaye
CP12

Investment decision making and industry organisation in power systems: centralised planning and the emerging competitive models. The Nodal Auction Model as a theoretical basis for implementing competition in the electricity industry. Planning in a competitive electricity industry: forward markets and the concept of coordinated pricing and planning. The role and implementation of regulation. Sustainability and the role of distributors. Review of practical approaches adopted internationally and in Australia.

ELEC9202
Power Systems Operation and Control
Staff Contact: Dr R.J. Kaye
CP12

Introduction to the main techniques currently used in the operation and control of power systems: economic dispatch and optimal power flow; unit commitment; fuel scheduling and management of storage hydro-electric releases; production costing, reliability calculations and operations planning. Current trends towards decentralisation of operations decision making: inter-connection, third-party generation, renewable energy sources and end-use efficiency. Power system pricing and decentralised operations.

ELEC9203
Power System Analysis
Staff Contact: A/Prof D. Sutanto
CP12 S2
Prerequisite: Assumed knowledge ELEC4202 or equivalent

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: A/Prof T.R. Blackburn
CP12
Prerequisite: Assumed knowledge ELEC4202 or equivalent
Note/s: This subject is not offered every year.

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: A/Prof T.R. Blackburn
CP12
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: A/Prof T.R. Blackburn
CP12

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: A/Prof T.R. Blackburn
CP12

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

ELEC9222
Special Topic in Power
Staff Contact: A/Prof T.R. Blackburn
CP12

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

ELEC9223
Power Engineering Seminar
Staff Contact: A/Prof H.R. Outhred
CP12

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: A/Prof T.R. Blackburn
CP8

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: A/Prof T.R. Blackburn
C8

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

ELEC9226
Electrical Services in Buildings
Staff Contact: A/Prof T.R. Blackburn
CP12
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, A/Prof F. Rahman
CP12
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.

ELEC9330
Special Topic
Staff Contact: Dr H. Mehrpour
CP12

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

ELEC9336
Digital Communication Networks
Staff Contact: A/Prof T.B. Vu
CP12
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 H. Mehrpour
CP12
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. Case studies: ARPAnet, Asynchronous Transfer Mode (ATM)

ELEC9338
Television and Video Signal Processing
Staff Contact: Dr R.A. Zakarevicius
CP12
Prerequisites: Assumed knowledge ELEC3013, 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.

ELEC9340
Communication Electronics
Staff Contact: Dr R.A. Zakarevicius
CP12
Prerequisite: Assumed knowledge ELEC3013, ELEC3 016 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: A/Prof W.H. Holmes, Dr R. Radzyner
CP12
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
CP12
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, including filter banks and wavelets; 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, including filter banks and wavelets, 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: Dr R. Radzyner/Dr T.O. Tsun
CP12
Prerequisite: ELEC2012 or similar
Note/s: Excluded ELEC4323.

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. Matched filter receiver; power limited and bandwidth limited transmission. Intersymbol interference and eye patterns. Information Theory; Entropy, source coding, channel capacity. Coding theory; Block, cyclic and convolutional codes; Viterbi decoding; Trellis coded modulation. Spectrum control; link analysis.

ELEC9347
Digital Modulation
Staff Contact: Dr T.O.Tsun
CP12
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
CP12

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. Optical sensors.

ELEC9351
Propagation and Transmission of Electromagnetic Waves
Staff Contact: Dr E.H. Fooks
CP12

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: A/Prof T.B. Vu
CP12
Prerequisite: ELEC9351

Principles of phased arrays and reflector antennas with some emphasis on space-borne and ground-terminal antennas for satellite communications. Analysis and synthesis of phased array, null steering theory. Single and dual reflector antennas, offset-reflector systems, optimization techniques. Effects of satellite orbital saturation on design of ground terminal antennas. Monopulse tracking antennas. Antenna tolerance theory.

ELEC9353
Microwave Circuits: Theory and Techniques
Staff Contact: Dr E.H. Fooks
CP12

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 characterisation and use of microwave transistors and diodes. Microwave subsystems.

ELEC9354
Microwave and Optical Devices
Staff Contact: Dr T.O. Tsun
CP12

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
CP12
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. 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
CP12

The fundamentals of digital image processing with topics selected from the following: Visual perception and the

image model, transforms, enhancement, sharpening and smoothing, restoration, encoding, segmentation, reconstruction of images from projections and tomography, satellite imaging and imaging in remote sensing; image processing hardware and systems; picture processing; measurement and inspection.

ELEC9401
Computer Control Systems 1
Staff Contact: A/Prof P.D. Neilson
CP12

An introduction to the use of CAD packages and coverage of the control theory necessary to understand the design of fundamental control systems. Selected computer packages, sampling and conversion, difference equation models, polynomial forms, z-transforms, differential equation models, operator forms, s-transforms, block diagrams, flow diagrams and state space models, connections between discrete and continuous models, classical continuous design, Root locus, Nyquist, Bode, classical discrete design, w-transforms, PID controllers, simple controller design schemes (time polynomial), Dahlin Higham, pole placement, approximations, Smith predictor, deadbeat, stochastic observers, pre-whitening, stochastic processes, time domain, frequency domain, correlation, identification, moving average models.

ELEC9402
Computer Control Systems 2
Staff Contact: A/Prof P.D. Neilson
CP12
Prerequisite: ELEC9401

Builds on the material of ELEC9401, 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
CP12
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
CP12
Prerequisites: ELEC9401, ELEC9402

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

ELEC9405
Advanced Control Topics
Staff Contact: A/Prof P.D. Neilson
CP12
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
CP12

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
CP12

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
CP12

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
CP12 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
CP12
Note/s: Excluded ELEC9341.

Digital computer methods of extracting information from biological signals using filtering and averaging, expectation density functions, correlation functions, spectral analysis and other techniques. Methods of constructing models of biological systems.

ELEC9415
Optimization and Optimal Control
Staff Contact: Dr D.J. Clements
CP12 SS
Prerequisites: 1 undergraduate Control subject plus MATH2501

Constrained and unconstrained optimization. Linear quadratic and geometrical programming techniques, the simplex method, Kuhn-Tucker necessary conditions, gradient methods. Dynamic optimization, dynamic programming, the optimum principle. Design and control systems by optimization methods.

ELEC9416
Non-linear Systems and Simulation
Staff Contact: Prof N.W. Rees
CP12 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.

ELEC9501
Advanced Semiconductor Devices
Staff Contact: Dr C. Honsberg
CP12
Note/s: Excluded ELEC4512.

Theory and operating characteristics of a range of semiconductor devices including bipolar diodes and transistors, MOS devices and circuit connections, solar cells, light emitting diodes and semiconductor lasers.

ELEC9502
Integrated Circuit Technology
Staff Contact: A/Prof S.R. Wenham
CP12

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
CP12
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: A/Prof S.R. Wenham/Dr R. Ramer
CP12

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: A/Prof S.R. Wenham
CP12

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

ELEC9507
Solar Cells and Systems
Staff Contact: Dr C.B. Honsberg
CP12
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 sensitivity, 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
CP12
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, recombination 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.

ELEC9509
Photovoltaics
Staff Contact: A/Prof S.R. Wenham
CP12
Assumed knowledge: ELEC2020 or equivalent
Note/s: Excluded ELEC4540.

Brief consideration of the operating principles of solar cells and their interaction with sunlight to facilitate electricity generation. Solar cell electrical output characteristics are studied, leading to system design considerations based on the interconnection of large numbers of solar cells. Considerable emphasis is placed on photovoltaic applications, including design approaches, and evolutionary trends.

ELEC9912
Project Report
Staff Contact: A/Prof K.E. Tait
CP48

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.

School of Geomatic Engineering

Head of School
Professor J.C. Trinder

Administrative Officer
Mr L. Daras

Geomatics is a modern scientific term to describe an integrated approach to the acquisition, analysis, storage, distribution, management and application of spatially-referenced data. It embraces the traditional area of surveying and mapping, as well as the comparatively new fields of remote sensing and spatial information systems.

Today, a geomatic engineer may choose to work in one of the specialised areas of:

- **Satellite Surveying** (position determination techniques using satellite signals)
- **Geodesy** (determining the mathematical model of the Earth, and its gravity field, and the practice of control network surveying)
- **Hydrography** (mapping the seabed and waterways for navigation and off-shore resource management)
- **Engineering Surveying** (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 and administration purposes)
- **Geographic Information Systems (GIS)** (computer-based information systems for environmental assessment and monitoring)
- **Photogrammetry and Remote Sensing** (the use of airborne and spaceborne remotely sensed images for mapping and resource surveys).

The three undergraduate degrees in the School are the Bachelor of Engineering in Geomatic Engineering course **3741** and the combined degree of Bachelor of Engineering in Geomatic Engineering, Bachelor of Science in Computer Science course **3746** and the combined BE/BA course **3747.**

Formal graduate courses lead to the award of the degree of Master of Engineering Science in Geomatic Engineering **8652** and of the graduate diploma in Geomatic Engineering **5492.** Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering in Geomatic Engineering **2721** and Doctor of Philosophy **1681**.

The School of Geomatic Engineering 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 **8047.2000** or the Graduate Diploma in Remote Sensing and Geographic Information Systems **5047.2000** or **5496** in addition to supervision for the degree of Doctor of Philosophy. A Graduate Diploma in Land Administration **5493** was introduced in 1996. Students may undertake selected subjects in the Master of Engineering Science and Graduate Diploma by distance learning. Fees are payable for distance learning subjects. A Master of Engineering Science (Land Administration) has also been developed for introduction in 1997.

Bachelor of Engineering (Geomatic Engineering) Course

The School offers a full-time course of four years duration leading to the award of the degree of Bachelor of Engineering - BE (Geomatic Engineering) 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 up to two consecutive sessions. The BE (Geomatic Engineering) degree course is a well rounded course aimed at preparing the graduate for a broad range of career opportunities in the various branches of Geomatic Engineering and in associated fields referred to above. The course recognises that its graduates may be called on to act as survey practitioners, consultants, managers, teachers or researchers, and indeed a single graduate may take on several of these roles during his or her career. To this end, the BE (Geomatic Engineering) degree course covers general scientific principles with special emphasis on computing, as well as specialised Geomatic Engineering applications. Throughout the course, theoretical studies are complemented by practical exercises in the field and in the laboratory.

Recognition

The degree of BE (Geomatic Engineering) is recognised by the New South Wales Board of Surveyors as meeting all examination requirements for registration as a Registered Surveyor in New South Wales, and is recognised by the Institution of Surveyors, Australia for admission as corporate members.

Students wishing to become Registered Surveyors with the New South Wales Surveyors' Board after graduation are advised to gain practical experience under a Registered Surveyor during their course. Details are obtainable from the Registrar, Surveyors' Board, Department of Lands, Bridge Street, Sydney 2000.

The degree also has accreditation with the Institution of Engineers Australia (IEAust.).

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.

Bachelor of Engineering in Geomatic Engineering/Bachelor of Science in Computer Science Course

This 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 Engineering in Geomatic Engineering. The course authority for the combined degree is the School of Geomatic Engineering. All students admitted to the combined course will be part of the Geomatic Engineering UAC quota (Code 423741) but must also have achieved a level equivalent to the Computer Science cut-off (423978) for the year of admission.

The course is specifically designed for students wishing to enter a career in computer science specialising 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 BE degree courses with some variations to accommodate the requirements of both degrees. The selection of subjects from both courses is flexible and it should be possible to complete the requirements for the award of the BE degree after four years study and the BSc degree after five years.

Combined Bachelor of Engineering(Geomatic Engineering)/Bachelor of Arts Course

With this combined degree course, students can add their choice of an Arts program to the standard, professionally accredited engineering course offered by the School of Geomatic Engineering. It provides flexibility in the choice of subjects within the full Arts program and enables students to gain a broad education in Arts and Social Sciences, as well as specialised studies in Geomatic Engineering.

Because Geomatic Engineering and Arts programs have a common content, such as mathematics and physics, approximately 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.

Organisation

The BE BA course is administered by the School of Geomatic 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. Students should work out for themselves the arts program they would like to add to their Geomatic Engineering course. The Arts and Social Sciences Faculty Handbook describes the options, and the School of Geomatic Engineering can supply sample programs showing possible progams.

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 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 Geomatic Engineering.

Rules

1. In addition to the BE course, students must complete 54 credit points in the BA course with no more that 24 credit points obtained at first level (i.e. subjects designed for students in their first year of study). Of these 24 first level credit point, no more than 12 may be from any one School or Department.

2. Students must complete a major sequence in one of the following areas:

Chinese, English, Environmental Studies, French, German Studies, History, Indonesian, Music, Philosophy, Political Science, Russian Studies, Science and Technology Studies, Social Science and Policy, Sociology, Spanish and Latin American Studies, Theatre and Film Studies.

Students completing an Environmental Studies major sequence must include, in addition to the 30 upper level credit points specified, 6 first level credit points in one of the following subjects: GEOG1031, POLS1014, or SCTS1001. Students must also complete a minor sequence of 18 credit points in one of the other areas listed above.

3. Except for subjects completed as part of the Environmental Studies major sequence, no more that 12 credit points may be obtained from subjects in the BA courses which are offered by Schools outside the Faculty of Arts and Social Sciences. The subject GEOG3032 Remote Sensing Applications is excluded for all students in the BE(Geomatic Engineering) program.

4. There will be a testamur for each part of the combined degree course.

5. Students who complete the BE program first may proceed to graduation with the degree of Bachelor of Engineering in the usual way.

6. 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.

Undergraduate Study

Computing Requirements

Information regarding recommended computing equipment for the courses offered by the School is available from the School Office.

English Requirement

Students entering the course are expected to have achieved HSC scores in English as follows: 2 unit English (General) 53-100, or 2 unit English (Related) 49-100, or 3 unit English (Related) 1-50, or 2 unit Contemporary 60-100. Students not meeting these standards are required to take remedial English studies offered by the English Support Unit.

Course Outlines

3741
Geomatic Engineering

Bachelor of Engineering in Geomatic Engineering BE

		HPW S1	HPW S2	CP
Year 1				
GMAT1111	Introduction to Computing	4	0	10
GMAT1713	Introduction to Geomatic Engineering*	3	0	7.5
GMAT2042	Professional Communications	0	3.5	9
GMAT2112	Principles of Computer Processing	0	3	7.5
GMAT2131	Survey Computations	0	2.5	6.5
GMAT2222	Introduction to Geodesy	0	2.5	6.5
GMAT2712	Introduction to Land Surveying	0	3	7.5
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	15
PHYS1998	Physics 1	6	0	15

Total HPW Session 1 19
Total HPW Session 2 20.5
Total Credit Points 99.5

Year 2				
GMAT3013	Surveying Instruments	4.5	0	11.5
GMAT3122	Computer Graphics 1	2.5	0	6.5
GMAT3231	Geodetic Computations	2.5	0	6.5
GMAT4052	Field Projects 1	0	2	5
GMAT4011	Surveying Techniques	0	5.5	14
GMAT4112	Data Analysis and Computing 1	0	3	7.5
GMAT4222	Geodetic Positioning	0	2.5	6.5
GMAT4811	Land Economics and Valuation	0	2.5	6.5
MATH2009	Engineering Mathematics 2	4	4	20
MATH2829	Statistics SU	3	0	7.5
PHYS2969	Physics of Measurements	3	0	7.5
General Education subject/s		2	2	15

Total HPW Session 1 21.5
Total HPW Session 2 21.5
Total Credit Points 114

Year 3				
CIVL0646	Introduction to Water Engineering	3	0	7.5
CIVL0656	Introduction to Municipal Engineering	0	3	7.5
GMAT5011	Engineering Surveying	3.5	0	9
GMAT5112	Data Analysis and Computing 2	2.5	0	6.5
GMAT5122	Computer Graphics 2	2.5	0	6.5
GMAT5222	GPS Surveying	2.5	0	6.5
GMAT5621	Cadastral Surveying 1	3	0	7.5
GMAT6052	Field Projects 2	0	4	10
GMAT6512	Principles of Image Geometry	0	3	7.5
GMAT6522	Remote Sensing	0	3	7.5
GMAT6532	Spatial Information Systems 1	0	3	7.5
GMAT6621	Cadastral Surveying 2	0	3	7.5
PLAN1093	Planning Studies	2	0	10
General Education subject/s		2	2	15

Total HPW Session 1 21
Total HPW Session 2 21
Total Credit Points 116

Year 4				
GMAT7052	Field Projects 3	3	0	7.5
GMAT7512	Photogrammetry and Mapping	3	0	7.5
GMAT7532	Spatial Information Systems 2	2	0	5
GMAT7612	Land Management and Development Project 1*	2	0	5
GMAT7722	Project Management 1	3	0	7.5
GMAT7811	Land Subdivision and Development	3	0	7.5
GMAT8001	Thesis	2	6	20
GMAT8011	Project Surveying	0	3	7.5
GMAT8222	Physical and Space Geodesy	0	2.5	6.5
GMAT8311	Offshore Positioning	0	2.5	6.5
GMAT8612	Land Management and Development Project 2*	0	2	5
GMAT8711	Professional Practice	2	1	7.5
GMAT8722	Project Management 2	0	3	7.5

Total HPW Session 1 20
Total HPW Session 2 20
Total Credit Points 100.5

**Includes General Education Social and Environmental Responsibility*

Combined Course

3746
Bachelor of Engineering in Geomatic Engineering/Bachelor of Science in Computer Science

BE BSc in Computer Science

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

Year 1
COMP1011 or GMAT4811
GMAT2042, GMAT1111, GMAT1713(General Education), GMAT2222, GMAT2131,
MATH1131 or MATH1141,MATH1231 or MATH1241,
PHYS1998

Year 2
COMP1011 or GMAT4811, COMP1021,
GMAT3013, GMAT3122, GMAT3231, GMAT4011, GMAT4052, GMAT4112, GMAT4222,
MATH2841, MATH2501, MATH2510, MATH2520,
PHYS2969,

Year 3
CIVL0646, CIVL0656
COMP2011, MATH2100, MATH2120,
GMAT5011,GMAT5112, GMAT5222, GMAT5621, GMAT6052, GMAT6512, GMAT6532, GMAT6621,
PLAN1093,
General Education subject/s

Year 4
GMAT6522,GMAT7052, GMAT7512, GMAT7612, GMAT7722, GMAT7811, GMAT8001, GMAT8011, GMAT8222, GMAT8612, GMAT8711, GMAT8311, GMAT8722

Year 5
COMP2021, COMP2031, COMP3111, COMP3121, COMP3311, COMP3421
Plus 2 subjects (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.

Graduate Study

Formal graduate courses lead to the award of the degrees of Master of Engineering Science **8652** and **8653,** and of the graduate diplomas in Geomatic Engineering **5492** and Land Administration **5493.**

Opportunities are provided for graduate research leading to the award of the degrees of Master of Engineering **2721** and Doctor of Philosophy **1681.**

The School of Geomatic Engineering 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 **1685.**

Master of Engineering Science

MEngSc

Programs of study leading to the degree of MEngSc are offered by the School of Geomatic Engineering in a range of topics including:

- advanced surveying,
- geodesy,
- photogrammetry,
- land administration,
- 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 120 credit points. Four credit points are 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 48 credit points. Examples of suitable external subjects are computing, statistics, oceanography, project management and a range of others.

8652
Geographic Information Systems

Master of Engineering Science
MEngSc

Candidates are required to complete a course totalling at least 120 credit points made up of compulsory core 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.

Core subjects		CP
GEOG9240	Principles of Geographic Information Systems	12
GEOG9241	Advanced Geographic Information Systems or	12
GEOG9280	Application and Management of GIS or	12
GMAT9604	Land Information Systems	12
Elective subjects		
COMP9311	Data Base Systems	12
ELEC9336	Digital Communication Networks 1	12
GEOG9150	Remote Sensing Applications	12
GEOG9290	Image Analysis in Remote Sensing	12
GMAT9107	Special Topic in Geomatic Engineering B	12
GMAT9532	Data Acquisition and Terrain Modelling	12
GMAT9600	Principles of Remote Sensing	12
GMAT9606	Microwave Remote Sensing	12
LIBS0815	Economics of Information Systems	10
LIBS0817	Information Storage and Retrieval Systems	15
Project		48

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

The Masters degree program in Geographic Information 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.

8653
Land Administration

Master of Engineering Science
MEngSc

The course is specifically designed for employees in developing countries and Australian consultants who are associated with the introduction of Land Title Reform programs in developing countries.

Candidates are required to complete a course totalling at least 120 credit points made up of nine compulsory core subjects and one elective subject. 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.

Core subjects		CP
ACCT5917	Strategic Management: Systems and Processes	12
CIVL8731	Project Management Framework	12
GMAT9604	Land Information Systems	12
GMAT9608	Cadastral Systems	12
GMAT9609	Land Registration Systems	12
GMAT9610	Reform in Land Titling and Registration	12
GMAT9611	Land Law for Land Administration	12
ILAS0301	Record Keeping Principles and Structures	12
SOCI5336	Sociology of Development	12
Elective subjects		
BLDG7101	Valuation 1 (Introduction)	12
BLDG7201	Valuation 2 ((Valuation Theory))	12
CIVL8701	Financial Management	12
GEOG9240	Principles of Geographic Information Systems	12
GEOG9241	Advanced Geographic Information Systems	12
GEOG9280	Application and Management of Geographical Information Systems	12
GMAT7532	Spatial Information Systems 2	12
GMAT9210	Satellite Surveying	12
GMAT9533	Land Use Mapping and Administration	12

8641
Remote Sensing

Master of Engineering Science
MEngSc

Candidates are required to complete a course totalling at least 120 credit points, made up of core 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 60 credit points) or two years of part-time study.

Core subjects		CP
GEOG9150	Remote Sensing Applications	12
GEOG9290	Image Analysis in Remote Sensing	12
GMAT9600	Principles of Remote Sensing	12
GMAT9606	Microwave Remote Sensing	12
Project in Remote Sensing (one elective project to be chosen from the list below)*		48

**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.

		CP
COMP1011	Computing 1A	15
COMP1021	Computing 1B	15
ELEC9370	Digital Image Processing Systems	12
ELEC9408	Computer Display Systems and Interactive Instrumentation	12
GEOG9210	Computer Mapping and Data Display	12
GEOG9240	Principles of GIS	12
GEOG9241	Advanced Geographic Information Systems	12
GEOL0360	Remote Sensing Applications in Geoscience	12
GMAT9604	Land Information Systems	12
GMAT9605	Field Data Collection and Integration	12
GMAT9280	Application and Management of GIS	12

5492
Graduate Diploma in Geomatic Engineering

GradDip

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

5493
Graduate Diploma in Land Administration

GradDipLandAdmin

Candidates are required to complete a course totalling 180 credit points, made up of six compulsory subjects, with compulsory attendance at seminars and work experience as prescribed by the course authority. The diploma will normally comprise one year of full-time study or two years of part-time study.

Core subjects		**CP**
ACCT5917	Strategic Management: Systems and Processes	12
CIVL8731	Project Management Framework	12
GMAT9604	Land Information Systems	12
GMAT9608	Cadastral Systems	12
GMAT9609	Land Registration Systems	12
SOCI5336	Sociology of Development	12

5496
Graduate Diploma in Remote Sensing

GradDip

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

Note: Students 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.

Subject Descriptions

GMAT0411
Surveying in Building and Construction
Staff Contact: A/Prof A. Stolz
CP7.5 S1 L1 T2
Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

Overview of services provided by Geomatic Engineers. Linear and angular measurement. Setting out. Levelling; laser levelling. Electronic tacheometry. Earthwork surveys. High-rise building surveys; quality assurance. Basic land law and cadastral systems. Subdivision surveys.

GMAT0441
Surveying for Engineers
Staff Contact: A/Prof A. Stolz, Dr B. R. Harvey
CP11.5 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.

GMAT0442
Surveying for Civil Engineers
Staff Contact: A/Prof A. Stolz
CP7.5 S1 L1.5 T1.5

A servicing subject for civil engineering students to introduce them to surveying and principles of geomatic engineering. Topics include: Linear and angular measurement (band and electronic distance measurement): Levelling principles and applications including laser levelling and bar code levelling; 3D co-ordinate systems; Traversing and control surveys, "field-to-finish" electronic detail surveys, electronic data recording; horizontal and vertical curves and construction survey set outs; areas and volumes, surveys to monitor deformations of structures and mine walls; GPS (satellite positioning); and an introduction to consulting services available from Geomatic Engineers.

GMAT0491
Survey Camp
Staff Contact: School Office
CP7.5
Prerequisite: GMAT0441
Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

A one-week field camp for students studying GMAT0441 Surveying for Engineers.

GMAT0580
Mining Surveying
Staff Contact: Mr S. Ganeshan
CP7.5 S1 L2 T1
Prerequisite: GMAT0441
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.

GMAT0752
Remote Sensing Techniques and Applications
Staff Contact: Prof B.C. Forster
CP10 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.

GMAT0753
Introduction to Spatial Information Systems
Staff Contact: School Office
CP5 S1 HPW2
Prerequisites: CIVL2710, MATH2869, MATH2019

To provide Environmental Engineers with an overview of the available sources of information and technologies of Spatial Information Systems and an introduction to analysis and modelling of data, particularly of environmental data. Provide an understanding of the role of other professions in SIS. Introduction to co-ordinate reference systems, with particular reference to Australia. Overview and background of spatial information systems. Explanations of definitions and terminology of LIS and GIS. Introduction to remote sensing. Sources of spatial information, field surveys including GPS, maps, aerial photography, satellite imagery. Introduction to image analysis techniques for remote sensing. Introduction to geographical information systems for display, management and analysis of spatial information. Modelling and analysis techniques and software for GIS. Application of above to environmental engineering. A view of the future.

GMAT1111
Introduction to Computing
Staff Contact: Dr B.R. Harvey
CP10 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.

GMAT1713
Introduction to Geomatic Engineering
Staff Contact: A/Prof A. Stolz
CP7.5 S1 L2 T1

Principles of geomatic engineering; geodetic positioning, photogrammetry and remote sensing; cadastral surveying and land information management; engineering, mining, geophysical and hydrographic surveying. Mapping .Geomatic engineering profession, key values, professional ethics, current and future challenges. Basic surveying measurements (angles, distances, height). Propagation of errors. Elements of surveying instruments: tubular level, prism, surveying telescope (including focussing, parallax, pointing). Reconnaissance surveys, recovery sketches, surveying with steel tape. Area measurement by planimeters. Field exercises: reconnaissance survey, recovery sketch.

GMAT2042
Professional Communications
Staff Contact: A/Prof A.H.W. Kearsley
CP10 S2 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 grammar; tests for concise writing, formal correctness, 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.

GMAT2112
Principles of Computer Processing
Staff Contact: Ms L Li
CP7.5 S2 L1.5 T1.5
Corequisite: GMAT1111

Program structure; subroutines, functions, control structures. Program libraries; creation, system libraries. Data structure and data manipulation. Data files: types and organisation, spreadsheets. Databases;: concepts, types, information management and access.

GMAT2131
Survey Computations
Staff Contact: Mr S. Ganeshan
CP6.5 S2 L1.5 T1
Corequisite: GMAT1111

Intersection, resection, trilateration, missing data problems, raod intersections, subdivision calculations, transformations, traverse computations, introduction to PCs and MS DOS.

GMAT2222
Introduction to Geodesy
Staff Contact: A/Prof A. Stolz
CP6.5 S2 L2 T.5

Definition of geodesy. Historical development of geodesy. Geodesy and other sciences. Geodesy in Australia. Earth's gravity field. Time in geodesy. Earth satellite motion. Coordinates and coordinate systems used in geodesy. Terrestrial geodetic methods. Space geodetic methods. Applications of geodesy.

GMAT2712
Introduction to Land Surveying
Staff Contact: A/Prof A. H.W. Kearsley
CP7.5 S2 L2 T1
Corequisite: GMAT1713

Coordinate systems, map projections and coordinate transformations. Overview on theodolites and electronic distance measurement. Automatic levelling instruments: principle, construction, compensators, errors, testing and adjustment. Laser levels. Principles of and field techniques for line and area levelling. Levelling errors, loop misclosures and adjustment. Effect of earth curvature and refraction. Bench marks. Field exercises in testing and adjustment of levelling instruments, area levelling and line levelling.

GMAT3013
Surveying Instruments
Staff Contact: A/Prof J. M. Rueger
CP11.5 S1 L3 T1.5
Prerequisites: GMAT1713, GMAT2712, GMAT2042

Introduction to surveying bands and tapes. Introduction to the uncertainty of measurements at 95% level of confidence. Precise levelling instruments: principles, construction, errors. Precise levelling staffs. Precise levelling errors and measuring techniques. Precision of 1km levelling runs. Electronic theodolites: principles, construction, electronic circles, electronic level sensors, errors, testing and adjustment. Electronic data recording. Levelling and centring of theodolites. Field exercises in precise levelling and the use of theodolites (centring, levelling, angular measurements). Laboratory exercise in adjustment of theodolites.

GMAT3122
Computer Graphics 1
Staff Contact: Dr B.R. Harvey
CP6.5 S1 L1 T1.5

Graphic communication. Computer aided drawing. Cartographic design. 2D - 3D visualisation. Engineering drawing and descriptive geometry. Familiarisation with two common CAD packages used by geomatic engineers.

GMAT3231
Geodetic Computations
Staff Contact: A/Prof A.H.W. Kearsley
CP6.5 L2 T.5
Corequisites: MATH2009, GMAT1111

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.

GMAT4011
Surveying Techniques
Staff Contact: A/Prof J. M. Rueger
CP14 S2 L4 T1.5
Prerequisite: GMAT2131
Corequisites: GMAT3013, GMAT3122

Horizontal direction and zenith angle measurement: principles, observation and reduction procedures and errors. Measurement of the inclination of the vertical axis. Trigonometric heighting. Point positioning by traversing, field procedures, error detection, error propagation, computation of coordinates of satellite stations. Contouring and detail surveys by electronic tacheometry. Electronic distance measurement: principles, corrections, reduction, electro-optical distance meters, calibration. Field exercises in contour and detail survey, 3-D resection with theodolite, traversing.

GMAT4052
Field Projects 1
Staff Contact: A/Prof J.M. Rueger
CP5 S2 T2
Corequisites: GMAT3013, GMAT4011
Note/s: Students are required to attend a one-week survey camp in week 10 of session 2 which is equivalent to 2 class contact hours per week (in addition to the normal weekly load in week 10.

The field projects involve a traverse with electronic distance measurement between two control points, a contour survey by electronic tacheometry, line levelling, setting-out of a building with electronic tacheometry and the calibration of an electronic tacheometer.

GMAT4112
Data Analysis and Computing 1
Staff Contact: Dr B.R .Harvey
CP7.5 S2 L2 T1
Prerequisites: MATH1131, MATH1231, GMAT2112, GMAT2131
Corequisite: MATH2829

Least squares estimation: application to survey network analysis using existing software packages; and theoretical development of parametric method. Statistical analysis of survey data. Computer communications, operating system commands and file management. Matrix algebra computer packages and spreadsheets for data analysis.

GMAT4222
Geodetic Positioning
Staff Contact: Mr S. Ganeshan
CP6.5 S2 L1.5 T1
Prerequisite: GMAT2222
Corequisites: GMAT1111, GMAT3231

Review of reference systems in classical positioning. Introduction to positional astronomy; determination of azimuth from sun and close circumpolar stars. Principles of astro-geodesy. Geodetic datum definition by classical techniques. Heights and the Australian Height Datum.

GMAT4811
Land Economics and Valuation
Staff Contact: Prof J. C. Trinder
CP6.5 S2 L2 T.5

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.

GMAT5011
Engineering Surveying
Staff Contact: Mr S. Ganeshan
CP9 S1 L3 T.5
Prerequisites: GMAT4011

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, plumbing of shafts and high structures.

GMAT5112
Data Analysis and Computing 2
Staff Contact: Dr B. R. Harvey
CP6.5 CP6.5 S1 L2T.5
Prerequisites: GMAT4112, MATH2829

Statistical analysis of survey data. Error ellipses and datums. Simulations and network design. Analysing least squares output. Theory of combined and condition least squares methods. 3D transformations. Computer programming aspects of least squares. Introduction to advanced least squares.

GMAT5122
Computer Graphics 2
Staff Contact: School Office
CP7.5 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.

GMAT5222
GPS Surveying
Staff Contact: Dr C. Rizos
CP6.5 S1 L2T.5
Prerequisite: GMAT4222
Corequisite: GMAT4112

Principles of satellite positioning. Introducing the GPS System. The GPS satellite, signal and measurement characteristics, GPS instrumentation, GPS surveying: planning, field and office issues. GPS observations and equations. Introduction to GPS baseline processing. Ambiguity resolution and modern GPS surveying. From baselines to networks: quality control issues. Result presentation: datums, coordinate systems and heights. Transforming and constraining GPS networks

GMAT5621
Cadastral Surveying 1
Staff Contact: Mr M. Green
CP7.5 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.

GMAT6052
Field Projects 2
Staff Contact: Mr S. Ganeshan
CP10 S2 T4
Prerequisite: GMAT4052
Corequisite: GMAT5011
Note/s: Students are required to attend a one week survey Camp in the week before Session 2, which is equivalent to 3 class contact hours per week plus 1 hour per week for preparation of plans during Session 2.

Students are required to attend a one week survey camp during the mid-year recess (equivalent to 3 contact hours per week) followed by one hour per week processing during session.

At camp, a survey project of substantial extent is carried out, involving detail surveys, contours surveys and the setting-out of a road. The processing of the field data and the preparation of plans and reports is done during session.

GMAT6512
Principles of Image Geometry
Staff Contact: Prof J. C. Trinder
CP7.5 S2 L2 T1

Introduction to geometric and spectral properties of remotely sensed images. Analogue and digital imagery - photographic, electro-optical, array and microwave systems. Image system geometry - central projections, sensor calibration, platform orientation. Inner orientation, collinearity equations, deviations from collinearity. Concept of stereoscopic vision. Exterior orientation of sensor systems. Object geometry from overlapping images. Principles of instrumentation for display of mono and stereo image data. Mapping applications of remotely sensed data.

GMAT6522
Remote Sensing
Staff Contact: Prof B. C. Forster
CP7.5 S2 L2 T1

Introduction to the physics of remotely acquired imagery. Atmospheric effects. Analogue and digital measures of image data. Visible, infrared, thermal and radar images. Image interpretation. Thematic processing of image data-preprocessing and classification. Field procedures for analysis and accurate assessment of output. Thematic information - field sampling, class boundaries, impact of sensor resolution and thematic class complexity. Applications for renewable and non-renewable resources.

GMAT6532
Spatial Information Systems 1
Staff Contact: Dr E. G. Masters
CP7.5 S2 L2 T1
Corequisite: GMAT5122

Overview and background of Spatial Information Systems. Explanation of definitions and terminology. Theory and application of SIS technology; digital maps and data base management; data acquisition; data storage, editing, raster and vector representations; topology. Modelling and analysis. Design and development of spatial databases. Use of GIS packages.

GMAT6621
Cadastral Surveying 2
Staff Contact: Mr M. Green
CP7.5 S2 L2 T1
Corequisite: GMAT5621

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.

GMAT7052
Field Projects 3
Staff Contact: School Office
CP7.5 S1 T3
Prerequisites: all Year 3 subjects
Note/s: Students are required to attend a one week survey camp during session (equivalent to 2 contact hours per week).

The field projects are selected from areas of cadastral, engineering and geodetic surveying. One hour per week during the session is set aside for the planning and preparation for field work and computations and the preparation of plans and reports.

GMAT7512
Photogrammetry and Mapping
Staff Contact: Prof J.C. Trinder
CP7.5 S1 L2 T1
Prerequisite: GMAT6512

Geometric aspects of blocks of image data. Registration of image blocks to ground coordinate systems. Semi-analytical and analytical methods of aerial triangulation, adjustment by models and bundles, measurement of platform orientation. Control requirements for block adjustment. Procedures for computation of geometry and electro-optical and radar images. Image processing: noise filtering, contrast enhancement and equalisation across boundaries, edge enhancement and extraction, image matching. Differential rectification, orthoimages. Output products, digital vector data, DEMs, cartographic images. Project planning. Close range applications of image sensing.

GMAT7532
Spatial Information Systems 2
Staff Contact: Ms L. Li
CP5 S1 L1 T1
Prerequisite: GMAT6532

Management and application of spatial information systems; system lifecycle; costs and benefits. Institutional issues. Data management; land information as maps and records. Existing systems. Future developments.

GMAT7612
Land Management and Development Project 1
Staff Contact: Mr M. Green
CP5 S1 L1 T1
Corequisite: GMAT7811

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 road hierarchy.

GMAT7722
Project Management 1
Staff Contact: Prof J.C. Trinder
CP7.5 S1 L2 T1
Corequisite: GMAT8722

Types of business, ethics. Organisational 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: organisation, 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.

GMAT7811
Land Subdivision and Development
Staff Contact: Prof J. C. Trinder
CP7.5 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.

GMAT8001
Thesis
CP20 S1 T2 S2 T6
Prerequisite: all Year 3 subjects

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 report on the work undertaken. Time devoted to the project is two hours 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.

GMAT8011
Project Surveying
Staff Contact: A/Prof J.M.Rueger
CP7.5 S2 L2 T1
Corequisites: GMAT5011

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; lengths transducers; alignment surveys; interferometer applications; collimation and auto-collimation techniques; optical tooling; principal and use of gyrotheodolite; electronic tiltmeters; inertial surveys. Laboratory exercises on dimensional measurement and north-seeking gyroscope.

GMAT8222
Physical and Space Geodesy
Staff Contact: A/Prof A. Stolz
CP6.5 S2 L2 T.5
Prerequisite: GMAT5222

Space geodetic techniques and observables. Geodetic parameter estimation. Applications. Height systems and datums. Gravimetric geoid evaluation. Applications of GPS heighting to levelling.

GMAT8311
Offshore Positioning
Staff Contact: Dr C. Rizos
CP6.5 S2 L2 T.5
Prerequisite: GMAT5222

Review of satellite-based position fixing. GPS instrumentation for offshore positioning. Mathematical principles of GPS point positioning, factors influencing point positioning accuracy. Differential GPS positioning: procedures, scenarios, services, DGPS applications and future enhancements.

Introduction to the Law of the Sea, background to UNCLOS, definition of terms. Territorial Sea baselines. Continental Shelf and EEZ, boundary delimitation between states, the High Sea and the Enterprise, Case Studies. The Australian context.

GMAT8612
Land Management and Development Project 2
Staff Contact: Mr M.Green
CP5 S2 L1 T1
Prerequisite: GMAT7612
Corequisite: GMAT7811

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.

GMAT8711
Professional Practice
Staff Contact: Dr B.R. Harvey
CP2.5 F T1
Prerequisite: All Year 3 subjects

Students must complete 60 days of approved professional practice prior to the completion 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. In addition, students are examined in several practical surveying tasks (including levelling and traversing).

GMAT8722
Project Management 2
Staff Contact: Prof J. C. Trinder
CP7.5 S2 L2 T1
Corequisite: GMAT7722

Aims and forms of project organisation. 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. Case studies in the application of project management

GMAT9106
Special Topic in Geomatic Engineering A
CP12

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

GMAT9107
Special Topic in Geomatic Engineering B
CP12

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.

GMAT9121
Network and Deformation Analysis
Staff Contact: Dr B. R. Harvey
CP12 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 optimization of deformation monitoring networks, two-epoch analysis, multi-epoch analysis, case studies of monitoring networks.

GMAT9122
Elements of Geodetic Equipment
Staff Contact: School Office
CP12 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.

GMAT9210
Satellite Surveying
Staff Contact: A/Prof C. Rizos
CP12 S1 L2 T.5

Principles of satellite positioning. Introduction to the GPS System: GPS Satellite, signal and measurement characteristics. GPS instrumentation. GPS surveying: planning, field and office issues. GPS observations and equations. Introduction to GPS baseline processing. Ambiguity resolution and modern GPS surveying techniques. Precise non-survey applications of GPS.

GMAT9211
Introduction to Geodesy
Staff Contact: A/Prof A.Stolz
CP12 S2 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.

GMAT9212
GPS Surveying
Staff Contact: A/Prof C. Rizos
CP12 S1 L2 T1

Introduction to GPS, satellite positioning, the GPS system, field planning and office procedures, GPS instrumentation, modelling, GPS observables, introduction to data processing, use of software, ambiguity resolution, modern GPS surveying techniques, baseline adjustment within networks, transformations, height determination. Tutorials and field exercises will focus on mathematical modelling issues, understanding GPS performance using commercial hardware/software systems.

GMAT9215
Satellite Geodesy
Staff Contact: A/Prof A. Stolz
CP12 SS L2 T1
Corequisite: GMAT9211

Time and reference coordinate systems. Satellite orbital motion. Orbit determination. Observation techniques and observables. Geodetic parameter estimation. Applications.

GMAT9530
Analytical Photogrammetry
Staff Contact: Prof J. C. Trinder
CP12 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.

GMAT9532
Data Acquisition and Terrain Modelling
Staff Contact: Prof J.C. Trinder
CP12 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.

GMAT9533
Land Use Mapping and Administration
Staff Contact: Prof B.C. Forster
CP12 S2 L2 T1

Land as a fundamental resource, general concepts. Factors affecting rural and urban land use - physical, social, economic. Examples from various regions of the world. Land use administration procedures. Data/information

needs. Land use classification systems. Land capability. Land resource inventory surveys. Mapping tools, including field survey, photogrammetry and remote sensing. Properties of photogrammetric and remotely sensed images. Image geometry. Image interpretation. Use of stereoscopic images. Photogrammetric mapping procedures. Image analysis procedures. Topographic and thematic may production. Use of maps, map products and GIS in land use administration.

GMAT9600
Principles of Remote Sensing
Staff Contact: Prof B.C. Forster
CP12 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.

GMAT9604
Land Information Systems
Staff Contact: Dr E.G. Masters
CP12 SS L2 T1

Land information as maps and records. Methods of data collection. Integrated surveys and coordinate systems. Legal boundaries. Land tenure. Identifiers. Computerisation 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.

GMAT9605
Field Data Collection and Integration
Staff Contact: Prof B.C. Forster
CP12 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.

GMAT9606
Microwave Remote Sensing
Staff Contact: Prof B.C. Forster
CP12 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.

GMAT9608
Cadastral Systems
Staff Contact: Dr E. Masters
CP12 S1 HPW3

Cadastre, types of systems, components, administration and principles of cadastral systems - cadastral systems in developed and developing countries, graphical and numeric cadastral, current systems in Asia, components and administration in New South Wales and other Australian states, systems of land tenure. Cadastral parcel identification systems - concepts of parcel identifiers, map based, survey plan based, administrative area, document identifier, current approaches in Asia, changes required for computerisation. Cadastral surveys and adjudication, cadastral regulatory approaches - fixed and general boundaries, strata surveys, aerial photo and paper defined title surveys, survey and title searching, survey marking and preparation of plans, appropriate statutes and regulations, registration/licensing and quality control of cadastral practitioners, the role of the private sector and examples from different jurisdictions, accuracy control and monitoring procedures. Reference systems, survey datums and GPS - introduction to national coordinate systems and datums, title definition by metes and bounds or coordinates, introduction to global positioning systems and their application in cadastral surveys. Cadastral reform and case studies - the benefits of cadastral reform, international case studies, British, Western Europe, USA, Malaysia and in particular the Thailand Titling project.

GMAT9609
Land Registration Systems
Staff Contact: Prof B.C. Forster
CP12 S2 HPW3

Classification and analysis of registration systems - historical background to land registration systems, the earliest systems, Greek, Roman, Chinese and other Asian cadastre, the Domesday Book, early continental European systems, the Napoleonic cadastre, English Old Law System, the Torrens System, current systems in Asia, deed registration and title registration, hybrid systems, essential differences between systems, systems that have state guarantee of ownership and boundaries. First registration, qualified and limited titles."Crown" or State land titles, owners rights, state rights, adverse possession. Land transactions, processes and record keeping - regulations for sale of land leases, licences, mortgages, transfer without sale, transfer at death, subdivision of land, land development, building regulations, transfer of interests prior to sale, centralised or local record offices, benefits and disbenefits of each, single authority or multiple authorities, computerised or paper records, security of records. Performance assessment - a comparison of the benefits and problems inherent in various land registration systems, measures of performance, ease of computerisation, match with traditional existing systems, ease of establishment, establishment costs, training needs, public acceptance.

GMAT9610
Reform in Land Titling and Registration
Staff Contact: Prof B. C. Forster
CP12 S2 HPW3

Introduction to the characteristics, purpose and outcomes of reform. Review of case studies. Market forces - social, economic, political and institutional influences on reform. Planning reform projects - understanding current land use, land ownership and registration, tradition, impact of reform on current land practices, ownership delineation and methods of survey, community involvement, appeal structures, schedules of implementation, man-power requirements, training and education. Case studies - detailed study of characteristics, purposes and outcomes of various reform programs; examples of successful land reforms in Africa, Europe, South America and Asia, detailed study of the Thailand Land Titling project. Change options and examples - analysis of the different approaches to reform in land titling and registration, centralised or distributed title office, costs and benefits. Overcoming resistance to change - achieving community involvement, public awareness programs, overcoming institutional, social and economic resistance to change. Cost-benefit and socio-economic studies. The impact of modern technology such as advanced digital transfer methods, computerised registration systems, advanced techniques for boundary measurement, and new title concept on the administration of land law. rights and responsibilities of individuals and government.

GMAT9611
Land Law for Land Administration
Staff Contact: Prof B. C. Forster
CP12 S2 HPW3

Principles and historical development of land law and the legal foundations of land administration. the legal basis for land ownership in established and developing countries, examples from Australia and countries with strong customary laws. Customary rights and legal rights of the state and individuals in different jurisdictions - examples of customary tenure and rights from various countries, examples of the rights of the state and individuals from developed and developing countries, the concept of eminent domain, individual and state legal rights over resources. relationships of land law to other laws - law and society, examination of the sociological assumptions about law, society and the relationships between law, legal institutions and social ordering, commercial law, local government and planning law, customary and common law, administrative law, public law, criminal law, law of inheritance. Interests in land and responsibilities under land laws - analysis of examples from various jurisdictions including developing and developed countries. International perspectives - comparative land law, the nature and sources of international law, the relationship between international and domestic law, international agreements, international litigation.

GMAT9950
Modern Technology in Geomatic Engineering
Staff Contact: Prof J.C. Trinder
S2
Note/s: By distance learning.

Introduction to geodetic reference systems; coordinate systems for satellite orbits, global positions, maps; geoid models. Contemporary computing techniques. New developments in field survey equipment including electronic data collection and coding, and field-to-finish systems. Satellite positioning and processing for surveying and navigation. Data acquisition for GIS. including field surveys, map digitising, photogrammetry and remote sensing. An introduction to GIS database design, development and applications.

GMAT9951
Land Information Systems
Staff Contact: Dr E.G. Masters
S2
Note/s: By distance learning.

Land information as maps and records. GIS development and implementation. Selected topics from system lifecycles, economics and cost-benefit analysis, methods of data collection, data refinement, data storage, data analysis and manipulation, data presentation, programming. Application of GIS technology. Land management and administration, cadastral systems, land tenure, identifying issues in Land Information Systems, data issues, software, hardware, standards, institutional issues, coordinate systems, data validation, quality.

GMAT9952
GPS Surveying
Staff Contact: A/Prof C. Rizos
S1
Note/s: By distance learning.

Introduction to GPS and satellite positioning, the GPS system; field planning and office procedures; GPS instrumentation; modelling GPS observables; introduction to data processing and the use of software; ambiguity resolution; modern GPS surveying techniques; baseline adjustment with networks; transformations; height determination. Tutorials and field exercises will focus on the mathematical modelling issues, as well as understanding GPS performance using commercial hardware/software systems.

GMAT9953
Principles of Remote Sensing
Staff Contact: Prof B.C. Forster
S1
Note/s: By distance learning.

History and development of remote sensing. Definition and physics of basic electromagnetic radiation quantities. Basic energy-matter relationship. spectral signatures of surfaces. Atmospheric considerations and the reduction of atmospheric effect. Sensor concepts including films and electro-optical sensors. Principles of thermal infrared and microwave remote sensing. An introduction to data processing and enhancement, including image interpretation procedures.

GMAT9906
Major Assignment
CP24

GMAT9912
Project
CP48

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
A/Prof 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, Mechatronic Engineering 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 **2692** and Doctor of Philosophy **1662**.

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

Co-operative scholars are selected largely on the basis of academic attainment, personal skills and motivation, as well as on non-academic achievements. Together with receiving a rigorous and broadly-based academic education, scholars gain first-hand experience in a wide variety of industries during 4 industrial training periods. These take place at the end of Year 1, end of Year 2 and two periods in 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.

The 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, mechanical and mechatronic 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. In a new initiative with the Graduate School of Biomedical Engineering there is also available a concurrent degree program leading to the award of Bachelor of Engineering/Master of Biomedical Engineering.

For the five current 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, Mechatronic Engineering and Naval Architecture are identical, and students attend classes together. The latter halves of these five courses contain a number of common core subjects together with specific disciplinary requirements. In the final year in the Mechanical Engineering and Mechatronic Engineering courses, in addition to core subjects and disciplinary requirements, provision is made for a limited degree of specialisation 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.

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, recognises 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 recognised 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 recognised 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, MECH4001 Communications for Professional Engineers and MECH4002 The Engineer in Society can be taken only in the final year of a student's program.

Computing Requirements

Information regarding recommended computing equipment for the courses offered by the School is available from the School Office.

3610
Aerospace Engineering

3663
Manufacturing Management

3680
Mechanical Engineering

3685
Mechatronic Engineering

3700
Naval Architecture

Bachelor of Engineering
BE

		HPW S1	HPW S2	CP
Year 1 of all courses				
CHEM1807	Chemistry 1ME	0	4	**10**
MANF1100	Workshop Technology	3	0	**7.5**
MANF1110	Manufacturing Technology	0	3	**7.5**
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	**15**
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	**15**
MECH1000	The Engineering Profession	1	0	**2.5**
MECH1100	Mechanical Engineering Design 1	1	2	**7.5**
MECH1110	Graphical Analysis and Communication	0	3	**7.5**
MECH1300	Engineering Mechanics 1	4	0	**10**
MECH1400	Mechanics of Solids 1	0	3	**7.5**
MECH1500	Computing 1M	0	3	**7.5**
PHYS1918	Physics 1ME	6	0	**15**

Total HPW Session 1 **21**
Total HPW Session 2 **24**
Total Credit Points **112.5**

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:

		HPW S1	HPW S2	CP
Year 1				
CHEM1101	Chemistry 1A	6	0	**15**
MANF1100	Workshop Technology	3	0	**7.5**
MANF1110	Manufacturing Technology	0	3	**7.5**
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	**15**
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	**15**
MECH1000	The Engineering Profession	1	0	**2.5**
MECH1100	Mechanical Engineering Design 1	1	2	**7.5**
MECH1110	Graphical Analysis and Communication	0	3	**7.5**
MECH1300	Engineering Mechanics 1	4	0	**10**
MECH1400	Mechanics of Solids 1	0	3	**7.5**
PHYS1002	Physics 1	6	6	**30**
and				
CHEM1201	Chemistry 1B (required for Materials Science majors)	0	6	**15**
or				
COMP1011	Computing 1A (required for Computer Science majors)	0	6	**15**
or				
1 relevant level I unit from the School of Physics or Mathematics undergraduate offerings in the Science Handbook		0	6	**15**

Total HPW Session 1 **27**
Total HPW Session 2 **29**
Total Credit Points **140**

Year 2 of all courses				
ELEC0807	Electrical Engineering 1E	0	3	**7.5**
MATH2009	Engineering Mathematics 2	4	4	**20**
MATH2839	Statistics SM	3	0	**7.5**
MATS9520	Engineering Materials	3	0	**7.5**
MECH2000	Preparation for Industrial Training	0	0	**0.5**
MECH2100	Mechanical Engineering Design 2	3	3	**15**
MECH2300	Engineering Mechanics 2A	3	0	**7.5**
MECH2310	Engineering Mechanics 2B	0	2	**5**
MECH2411	Mechanics of Solids 2A	3	0	**7.5**
MECH2412	Mechanics of Solids 2B	0	3	**7.5**
MECH2600	Fluid Mechanics 1	2	2	**10**
MECH2700	Thermodynamics 1	2	2	**10**
General Education subject/s		0	4	**15**

Total HPW Session 1 **23**
Total HPW Session 2 **23**
Total Credit Points **120.5**

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
The Aerospace Engineering course covers the analysis, design and operation of aircraft and spacecraft. Graduates work mainly on the design and manufacture of flight vehicles, their operation with major or satellite airlines and research for civil and military aerospace organisations. Owing to the international nature of the aerospace industry, the topics studied cover a similar area and , in general, to the same depth of understanding as professional training programs 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.

		HPW S1	HPW S2	CP
Year 3				
AERO3100	Aerospace Design 1	3	3	15
AERO3400	Analysis of Aerospace Structures 1	0	4	10
AERO3601	Aerodynamics 1	4	0	10
AERO3602	Flight Dynamics 1	2	0	5
ELEC0808	Electrical Engineering 2E	0	3	7.5
MANF3400	Engineering Economics	2	0	5
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3200	Engineering Experimentation	1.5	1.5	7.5
MECH3211	Linear Systems Analysis	3	0	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH3310	Vibration Analysis	0	2	5
MECH3400	Mechanics of Solids 3	4	0	10
MECH3510	Computing Applications in Mechanical Systems	2	0	5
MECH3800	Numerical Methods	0	3	7.5
General Education subject/s		2	2	15

Total HPW Session 1 23.5
Total HPW Session 2 23.5
Total Credit Points 122.5

		HPW S1	HPW S2	CP
Year 4				
AERO4100	Aerospace Design 2	3	3	15
AERO4201	Aerospace Systems	2	0	5
AERO4202	Space Engineering	0	2	5
AERO4400	Analysis of Aerospace Structures 2	3	3	15
AERO4601	Aerodynamics 2	2	2	10
AERO4602	Flight Dynamics 2	3	0	7.5
AERO4700	Aerospace Propulsion	2	2	10
MANF4400	Engineering Management	2	0	5
MECH4000	Thesis	6	6	30
MECH4001	Communications for Professional Engineers	0	2	5
MECH4002	The Engineer in Society	0	2	5
MECH4090	Industrial Training	0	0	0

Total HPW Session 1 23
Total HPW Session 2 22
Total Credit Points 112.5

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 S1	HPW S2	CP
Year 3				
ACCT9001/2	Introduction to Accounting A/B	1.5	1.5	15
MANF3200	Product Design and Manufacturing Technology	4	0	10
MANF3300	Design of Manufacturing Facilities 1	0	4	10
MANF3400	Engineering Economics	2	0	5
MANF3410	Quality Systems 1	4	0	10
MANF3500	Computers in Manufacturing 1	0	4	10
MANF3600	Information and Decision Making Technology 1	4	2	15
MANF3800	Introduction to Numerical Methods	0	1.5	4
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3211	Linear Systems Analysis	3	0	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH3510	Computing Applications in Mechanical Systems	2	0	5
General Education subject/s		2	2	15

Total HPW Session 1 22.5
Total HPW Session 2 20
Total Credit Points 119

Year 4				
MANF4010	Manufacturing Systems Design	2	2	10
MANF4300	Design of Manufacturing Facilities 2	0	4	10
MANF4410	Quality Systems 2	2	0	5
MANF4411	Introduction to Total Quality Management	0	1	2.5
MANF4420	Management of Manufacturing Systems	6	2	20
MANF4500	Computers in Manufacturing 2	2	0	5
MANF4600	Information and Decision Making Technology 2	4	0	10
MECH4000	Thesis	6	6	30
MECH4001	Communications for Professional Engineers	0	2	5
MECH4002	The Engineer in Society	0	2	5
MECH4090	Industrial Training	0	0	0

Total HPW Session 1 22
Total HPW Session 2 19
Total Credit Points 102.5

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.

		HPW S1	HPW S2	CP
Year 3				
ELEC0808	Electrical Engineering 2E	0	3	7.5
MANF3400	Engineering Economics	2	0	5
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3100	Mechanical Engineering Design 3	3	3	15
MECH3200	Engineering Experimentation	1.5	1.5	7.5
MECH3211	Linear Systems Analysis	3	0	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH3300	Engineering Mechanics 3	2	0	5
MECH3310	Vibration Analysis	0	2	5
MECH3400	Mechanics of Solids 3	4	0	10
MECH3510	Computing Applications in Mechanical Systems	2	0	5
MECH3600	Fluid Mechanics 2	2	0	5
MECH3701	Thermodynamics 2	0	2	5
MECH3702	Heat Transfer	2	0	5
MECH3800	Numerical Methods	0	3	7.5
General Education subject/s		2	2	15

Total HPW Session 1 23.5
Total HPW Session 2 21.5
Total Credit Points 117.5

		HPW S1	HPW S2	CP
Year 4				
MANF4400	Engineering Management	2	0	5
MANF4412	Total Quality Management	0	2	5
MECH4000	Thesis	6	6	30
MECH4001	Communications for Professional Engineers	0	2	5
MECH4002	The Engineer in Society	0	2	5
MECH4090	Industrial Training	0	0	0
Technical Electives		12	9	52.5

Total HPW Session 1 20
Total HPW Session 2 21
Total Credit Points 102.5

Mechanical Engineering Technical Electives

The requirement for the course will be determined by the total number of session-hours (21), not credit points.

At least 12 session-hours must be selected from the Mechanical Engineering list. The remaining 9 session-hours 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 with the approval of the Head of School. Express approval is also required for the selection of a subject from outside the School and such choice will normally be limited to one single session subject of 3HPW. 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 and demand. Students are advised in September of each year which Technical Electives will be offered in the following year.

		HPW S1	HPW S2	CP
Applied Mechanics				
MECH4301	Plane Mechanism Kinematics	3or 3		7.5
MECH4310	Advanced Vibration Analysis	3or 3		7.5
MECH4321	Engineering Noise 1	3	0	7.5
MECH4322	Engineering Noise 2	0	3	7.5
MECH4361	Lubrication	0	3	7.5
MECH4400	Fracture Mechanics	3or 3		7.5
MECH4410	Engineering Applications of Finite Elements	3or 3		7.5
MECH4420	Plates and Shells	3or 3		7.5
MECH4440	Theory of Plasticity	3or 3		7.5
Design				
MECH4110	Design Project	3	3	15
MECH4120	Design Technology	3or 3		7.5
MECH4130	Computer-Aided Engineering Design	3or 3		7.5
MECH4131	Advanced CAD Modelling and Applications	3or 3		7.5
MECH4150	Design and Maintenance of Components	3or 3		7.5
Fluid and Thermal Engineering				
MECH4610	Advanced Fluid Dynamics	3or 3		7.5
MECH4690	Special Fluid Mechanics Elective	3or 3		7.5
MECH4700	Turbomachines and Engines	3or 3		7.5
MECH4720	Solar Energy	3or 3		7.5
MECH4730	Multiphase Flow	3or 3		7.5
MECH4740	Thermal Power Plants	3or 3		7.5
MECH4751	Refrigeration and Air Conditioning	3or 3		7.5
MECH4790	Special Thermodynamics Elective	3or 3		7.5
General				
MECH4020	Group Engineering Project	3	3	15
MECH4800	Optimal Engineering Strategies	3	0	7.5
Possible External Technical Electives				
MATS9530	Materials Science for for Mechanical Engineers	3or 3		7.5
SAFE9213	Introduction to Safety Engineering (M)	3	0	12

3685
Mechatronic Engineering

Bachelor of Engineering
BE

Years 3 and 4

The Mechatronic Engineering course provides the student with the ability to acquire a hybrid range of skills based on mechanics, electronics and computing. Whilst there is a comprehensive coverage of mechanical engineering and design areas, the course enables a deeper understanding of the principles supporting the conception, design, construction, maintenance, integration and repair of intelligent machines. Typical examples of these machines are robots, white goods, cameras, automated test equipment and transport vehicles.

Typical fields which may be encompassed by the course include building services, computer controlled plant, manufacturing, robotics and materials handling. An emphasis is placed on the application of engineering science, development and management in these fields.

		HPW S1	HPW S2	CP
Year 3				
ELEC0808	Electrical Engineering 2E	0	3	7.5
MANF3400	Engineering Economics	2	0	5
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3100	Mechanical Engineering Design 3	3	3	15
MECH3200	Engineering Experimentation	1.5	1.5	7.5
MECH3202	Microprocessor Control	0	3	7.5
MECH3211	Linear Systems	3	0	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH3300	Engineering Mechanics 3	2	0	5
MECH3310	Vibration Analysis	0	2	5
MECH3400	Mechanics of Solids 3	4	0	10
MECH3510	Computing Applications in Mechanical Systems	2	0	5
MECH3600	Fluid Mechanics 2	2	0	5
MECH3701	Thermodynamics 2	0	2	5
MECH3702	Heat Transfer	2	0	5
General Education subject/s		2	2	15

Total HPW Session 1 **23.5**
Total HPW Session 2 **21.5**
Total Credit Points **117.5**

Year 4				
ELEC2042	Real Time Instrumentation	0	4	10
MANF4400	Engineering Management	2	0	5
MANF4412	Total Quality Management	0	2	5
MECH4000	Thesis	6	6	30
MECH4001	Communications for Professional Engineers	0	2	5
MECH4002	The Engineer in Society	0	2	5
MECH4090	Industrial Training	0	0	0
MECH4201	Advanced Digital Logic	3	0	7.5
MECH4221	Industrial Robotics	3	0	7.5
Technical Electives		6	6	30

Total HPW Session 1 **20**
Total HPW Session 2 **22**
Total Credit Points **105**

Mechatronic Engineering Technical Electives

The requirement for the course will be determined by the total number of session-hours (12), not credit points.

A student with a good academic record may be permitted to choose some postgraduate subjects as Technical Electives. Express approval is also required for the selection of a subject from outside the School. 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 the Technical Electives listed below can be offered each year. Those to be made available are decided on the basis of staff availability and demand. Students are advised in September of each year which Technical Electives will be offered in the following year.

		HPW S1	HPW S2	CP
Mechatronic Engineering				
MANF9500	CAD for Numerical Control	0	3	12
MECH4211	Modelling and Control of Mechatronic Systems	0	3	7.5
MECH4222	Intelligent Machines	3	0	7.5
MECH4223	Machine Condition Monitoring	0	3	7.5
MECH4300	Mechanics of Manipulatiors	3or	3	7.5
Computer Science and Engineering				
Electrical Engineering				
Choose at least one from the following list				
COMP3111	Software Engineering	5or	5	15
COMP3231	Operating Systems	5or	5	15
COMP3331	Computer Networks and Applications	0	5	15
ELEC3041	Real Time Engineering	4	0	15
Applied Mechanics				
Design				
Fluid and Thermal Engineering				
General				

See Mechanical Engineering Technical Electives

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 university 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 S1	HPW S2	CP
Year 3				
NAVL3100	Principles of Ship Design 1	1.5	1.5	7.5
NAVL3400	Ship Structures 1	2	2	10
NAVL3600	Ship Hydrostatics	2.5	2.5	12.5
NAVL3610	Ship Hydrodynamics	2.5	2.5	12.5
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3200	Engineering Experimentation	1.5	1.5	7.5
MECH3211	Linear Systems Analysis	3	0	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH3310	Vibration Analysis	0	2	5
MECH3400	Mechanics of Solids 3	4	0	10
MECH3510	Computing Applications in Mechanical Systems	2	0	5
MECH3800	Numerical Methods	0	3	7.5
ELEC0808	Electrical Engineering 2E	0	3	7.5
General Education subject/s		2	2	15

Total HPW Session 1 21
Total HPW Session 2 25
Total Credit Points 120

Year 4				
NAVL4000	Ship Management Economics	0	2	5
NAVL4100	Principles of Ship Design 2	4	2	15
NAVL4110	Ship Design Project	3	4	17.5
NAVL4400	Ship Structures 2	2	2	10
NAVL4700	Ship Propulsion and Systems	4	4	20
MECH4000	Thesis	6	6	30
MECH4001	Communications for Professional Engineers	0	2	5
MECH4002	The Engineer in Society	0	2	5
MECH4090	Industrial Training	0	0	0
MECH4500	Computing 3M	2	0	5

Total HPW Session 1 19
Total HPW Session 2 24
Total Credit Points 107.5

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

3686
BE BSc in Mechatronic 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,and the General Education requirements,

2. 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 whose TER is less than 90 are 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.

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

		HPW S1	HPW S2	CP
MECH2300	Engineering Mechanics 2A	3	0	**7.5**
MECH2411	Mechanics of Solids 1A	3	0	**7.5**
MECH2412	Mechanics of Solids 2B	0	3	**7.5**
MATH2100	Vector Calculus	2.5	0	**7.5**
MATH2120	Mathematical Methods for Differential Equations	0	2	**7.5**
MATH2501	Linear Algebra	2.5	2.5	**15**
MATH2510	Real Analysis	2.5	0	**7.5**
MATH2520	Complex Analysis	0	2.5	**7.5**
	4.5 Level II units[1]	9+	9+	**60+**

Total HPW Session 1 **22.5+**
Total HPW Session 2 **19+**
Total Credit Points **127.5+**

Year 3

MECH1500	Computing 1M	0	3	**7.5**
MECH2000	Preparation for Industrial Training	0	0	**0.5**
MECH2100	Mechanical Engineering Design 2	3	3	**15**
MECH2310	Engineering Mechanics 2B	0	2	**5**
MECH2600	Fluid Mechanics 1	2	2	**10**
MECH2700	Thermodynamics 1	2	2	**10**
	At least 5 appropriate Level II or III subjects of which at least 4 must be Level III[1]	10+	10+	**70+**
	General Education subject/s	2	2	**15**

Total HPW Session 1 **19+**
Total HPW Session 2 **24+**
Total Credit Points **133+**

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

+Indicates additional hours

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
MATH2100 (or MATH2110), MATH2120 (or MATH2130), MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620)
MATS9520
MECH2300, MECH2411, MECH2412
Total Credit Points 135

Year 3
ELEC0807
MATH2841 (or MATH2839)
MECH1500[2], MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
4 Level III subjects from undergraduate offerings of the School of Computer Science and Engineering in the Science Handbook
General Education subject/s
Total Credit Points 145.5

Materials Science Majors

Year 2
CHEM2011, CHEM2021
MATH2100 (or MATH2110), MATH2120 (or MATH2130), MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620)
MATS1002, MATS1042, MATS1072, MATS1112, MATS2213
MECH2300, MECH2411, MECH2412
Total Credit Points 132.5

Year 3
ELEC0807
MATH2841 (or MATH2839)
MATS1183, MATS1273, MATS2223, MATS4513, MATS4523, MATS4543
MECH1500[2], MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
POLY3010
General Education subject/s
Total Credit Points 140.5

Mathematics Majors

Year 2
Same Year 2 as for Computer Science[3] or Materials Science[3] or Physics or Statistics[4] majors
or
ELEC0807
MATH2100 (or MATH2110), MATH2120 (or MATH2130), MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620)
MATS9520
MECH2300, MECH2411, MECH2412
3.5 appropriate Level II subjects from undergraduate offerings in the Science Handbook including some from the School of Mathematics[5]
Total Credit Points 135

Year 3
MECH1500[2], MECH2000, MECH2100, MECH2310, MECH2600, MECH2700, MATH2841 (or MATH2839)
4 Level III subjects from School of Mathematics undergraduate offerings in the Science Handbook.
General Education subject/s
Total Credit Points 138

Physics Majors

Year 2
MATH2100 (or MATH2110), MATH2120 (or MATH2130), MATH2501 (or MATH2601), MATH2510 (or MATH2610), MATH2520 (or MATH2620)
MATS9520
MECH2300, MECH2411, MECH2412
PHYS2001, PHYS2011, PHYS2021, PHYS2031
Total Credit Points 135

Year 3
MATH2841 (or MATH2839)
MECH1500[2], MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
PHYS3010[6] or PHYS3210, PHYS3021, PHYS3030[6], or PHYS3230, PHYS3041[6]
1 Level III subject from School of Physics undergraduate offerings in the Science Handbook
General Education subject/s
Total Credit Points 138

Statistics Majors

Year 2
ELEC0807[6]
MATH2100 (or MATH2110), MATH2120 (or MATH2130), MATH2501 (or MATH2601),
MATH2510 (or MATH2610), MATH2520 (or MATH2620), MATH2801 (or MATH2901),
MATH2831 (or MATH2931), MATH2810 (or MATH2910), MATH2840 (or MATH2940)
MATS9520
MECH2300, MECH2411, MECH2412
0.5 appropriate Level II Science subject[5]
Total Credit Points 135

Year 3
MECH1500[2], MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
4 Level III subject from Statistics undergraduate offerings in the Science Handbook
1 Level II or III subject from School of Mathematics or School of Physics undergraduate offerings in the Science Handbook
General Education subject/s
Total Credit Points 138

Notes

1. 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 subjects 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 MATH2801 Theory of Statistics..

(d) They include PHYS2031 Laboratory or ELEC0807 Electrical Engineering 1E.

(e) They include MATS9520 Engineering Materials or MATS1273 Ferrous Physical Metallurgy A.

(f) They exclude MATH2301 Mathematical Computing A.

(g) All pre- and corequisites are satisfied.

2. With permission of the School of Mechanical and Manufacturing Engineering, students may take this subject in Year 2.

3. These Mathematics Majors need to add ELEC0807 Electrical Engineering 1E to Year 3.

4. These Mathematics Majors should substitute 1 Level II or III subjects from the Schools of Physics, Chemistry or Mathematics undergraduate offerings for MATH2841 Statistics in Year 3.

5. Students may substitute PHYS2031 Laboratory for ELEC0807 plus a 0.5 Level II subject.

6. 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.

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

3687
BE BA in Mechatronic 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.

Organisation

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

1. 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:
120 total including major sequence.

Other Faculties:
Major sequence plus at least 30 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. There will be a testamur for each part of the combined degree course.

3. Students who complete the BE program first may proceed to graduation with the degree of Bachelor of Engineering in the usual way.

4. 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.

Concurrent Degree Course

3683
Mechanical Engineering/Biomedical Engineering - Full-time Course

Bachelor of Engineering Master of Biomedical Engineering
BE MBiomedE

Course **3683** is a concurrent BE in Mechanical Engineering and Master of Biomedical Engineering. Further details on the course can be found in the Graduate School of Biomedical Engineering section.

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 **2692** and Doctor of Philosophy **1662**.

Master of Engineering Science MEngSc

The Master of Engineering Science degrees require a 72 credit coursework component and a 48 credit project, which must be completed in no more than two Sessions. A Specialist Program must be selected and at least 48 credit points must be chosen from this program. Details of Specialist Programs are given below.

8531 Manufacturing Engineering (MEngSc)

Specialist Programs

1. Computer Integrated Manufacturing

Core subjects:		CP
MANF9470	Production Management 1	12
MANF9560	Computer Integrated Manufacturing	12
MANF9543	CAD/CAM	12
MANF9544	Concurrent Product and Process Design	12
MANF9040	Seminar (Manufacturing)	0
MANF9010	Project	48
Elective subjects:		
MANF9410	Total Quality Management	12
MANF9601	Economic Decisions in Industrial Management	12
MANF9400	Industrial Management	12
MECH9410	Finite Element Applications	12
MANF9340	Flexible Manufacturing Systems	12
MANF9500	Computer-Aided Programming for Numerical Control	12

2. Industrial Management

Core subjects:		
MANF9400	Industrial Management	12
MANF9470	Production Management 1	12
MANF9410	Total Quality Management	12
MANF9040	Seminar (Manufacturing)	0
MANF9601	Economic Decisions in Industrial Management	12
MANF9010	Project	48
Elective subjects:		
MANF9340	Flexible Manufacturing Systems	12
MANF9543	CAD/CAM	12
MANF9544	Concurrent Product and Process Design	12
MANF9560	Computer Integrated Manufacturing	12
SAFE9224	Principles of Ergonomics	12

3. Manufacturing Management

This program is available in Flexible Delivery Mode (currently outside Australia) in conjunction with the Master of Business and Technology (MBT) program of the Faculty of Engineering. Therefore the structure and delivery mode of this program is different to those of the other programs (consult course adviser for further details). Students have to complete 9 subjects with a total of 120 credit points, 72 of which must be taken from the core subjects.

Core subjects:		CP
GSOE9102	Management of Manufacturing Systems	12
MANF8544	Concurrent Product and Process Design 12	
MANF8560	Computer Integrated Manufacturing	12
MANF8471	Manufacturing Strategy	12
MANF8340	Factory Automation	12
Elective subjects:		
GSOE9101	Project Management 12	
GSOE9104	Management of Innovation and Technological Change	12
GSOE9105	Risk Management	12
GSOE9107	Maintenance Management	12
GSOE9111	Organisation for Total Quality Management	12

or any other subject from the MBT program as approved by the Head of School.

8541 Mechanical Engineering (MEngSc)

Specialist Programs

4. Aerospace Engineering

Core subjects:		CP
AERO9105	Aerospace Vehicle Design and Manufacture	12
AERO9606	Aerodynamics	12
AERO9010	Project	48
Elective subjects:		
AERO9415	Finite Element Analysis and Applications for Aerospace Structures	12
AERO9705	Aerospace Propulsion	12
AERO9543	CAD/CAM for Aerospace Structures	12
AERO9607	Flight Dynamics	12

or such subjects as may be approved by the Head of School.

5. Computational Fluid Dynamics and Heat Transfer
Note: Subject descriptions for ANCE subjects are listed in this handbook under the Centre for Advanced Numerical Computation in Engineering and Science.

Core subjects:		CP
ANCE8001	Computational Mathematics	12
ANCE8002	Supercomputing Techniques	12
MECH9010	Project	48
Elective subjects:		
ANCE8101	Graphical Interfaces and Scientific Visualisation Techniques	12
ANCE8102	Mesh Generation	12
ANCE8105	Computational Fluid Dynamics *or* Computational Techniques for Fluid Dynamics	12
MECH9610	Advanced Fluid Dynamics	12
MECH9750	Industrial Applications of Heat Transfer	12

6. Refrigeration and Air Conditioning

Core subjects:		
MECH9751	Refrigeration and Air Conditioning 1	12
MECH9752	Refrigeration and Air Conditioning 2	12
MECH9753	Refrigeration and Air Conditioning Design 1	12
MECH9754	Refrigeration and Air Conditioning Design 2	12
MECH9010	Project	
Elective subjects:		
MECH9325	Fundamentals of Noise	12
MECH9326	Advanced Noise	12
MECH9610	Advanced Fluid Dynamics	12
MECH9720	Solar Thermal Energy Design	12
MECH9750	Industrial Applications of Heat Transfer	12
MECH9325	Fundamentals of Noise	12
MECH9326	Advanced Noise	12
MECH9730	Multiphase Flow	12
MECH9741	Energy Conservation and System Design	12
MECH9757	Ambient Energy Air Conditioning	2

7. Mechatronics

48 credit points of core subjects must be selected from:

MECH9201	Digital Logic Fundamentals for Mechanical Engineers	12
MECH9202	Microprocessor Fundamentals for Mechanical Engineers	12
MECH9203	Industrial Applications for Microprocessors	12
MECH9211	Modelling and Control of Mechatronic Systems	12
MECH9221	Industrial Robotics	12
MECH9222	Artificially Intelligent Machines	12
MANF9500	Computer Aided Programming for Numerical Control	12
MECH9010	Project	48

The remaining 24 credit points may be selected from the above list or from other subjects as approved by the Head of School.

8. Mechanical Design
In view of the diversity of the design activity, there are no core subjects. However, students' overall selection from the first six subjects listed below must be approved by the Head of the Design department before enrolment can be completed.

		CP
MECH9120	Design Technology	12
MECH9130	Computer-Aided Engineering Design	12
MECH9131	Advanced CAD Modelling and Applications	12
MECH9150	Design and Maintenance of Components	12
MECH9010	Project	48
Elective subjects:		
MANF9400	Industrial Management	12
MANF9544	Concurrent Product and Process Design	
MANF9601	Economic Decisions in Industrial Management	12
MECH9211	Modelling and Control of Mechatronic Systems	12
MECH9221	Industrial Robotics	12
MECH9310	Advanced Vibration Analysis	12
MECH9325	Fundamentals of Noise	12
MECH9400	Mechanics of Fracture and Fatigue	12
MECH9410	Finite Element Applications	12
MECH9740	Power Plant Engineering	12
SAFE9224	Principles of Ergonomics	12

or other subjects approved by the Head of School.

9. Noise and Vibration

Core subjects:		
MECH9311	Fundamentals of Vibration	12
MECH9312	Fundamentals of Noise and Vibration Measurement	12
MECH9325	Fundamentals of Noise	12
MECH9010	Project	48
Elective subjects:		
MECH9310	Advanced Vibration Analysis	12
MECH9323	Environmental Noise	12
MECH9324	Building Acoustics	12
MECH9326	Advanced Noise	12

or other subjects approved by the Head of School.

5455
Manufacturing Engineering

5456
Mechanical Engineering

Graduate Diploma
GradDip

The Graduate Diplomas are based on 96 credit points of coursework only. A Specialist Program must be selected and at least 48 credit points must be chosen from this program. Details of Specialist Programs are given above.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organisational 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.

AERO3100
Aerospace Design 1
Staff Contact: Mr J.R. Page
CP15 F HPW3
Prerequisites: MATS9520, MECH2100, MECH2411, MECH2412
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
CP10 S2 L3 T1
Prerequisites: MATH2009, MECH2411, MECH2412

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
CP10 S1 HPW4
Prerequisites: MATH2009, MECH2600, MECH2700
Corequisites: AERO3602

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
CP5 S1 HPW2
Prerequisites: MECH2300, MECH2310, MECH2600
Corequisite: AERO3601

Introduction to atmospheric and space environment; standard atmospheric gas law; pressure, temperature and density profiles; turbulence, gusts and atmospheric 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
CP15 F L2 T1
Prerequisites: AERO3100, AERO3601, AERO3602
Corequisites: AERO4400, AERO4601, AERO4602, AERO4700

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
CP5 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
CP5 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
CP15 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
CP10 F L1.5 T.5
Prerequisite: AERO3601

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
CP7.5 S1 L2 T1
Prerequisites: AERO3602, MECH3211

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: Dr R.T. Casey
CP10 F L1.5 T.5
Prerequisites: MECH2600, MECH2700

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.

AERO9010
Project
Staff Contact: Mr J.R.Page, Dr N.E.A. Ahmed
CP48
Note/s: The project must be completed in no more than two sessions.

AERO9105
Aerospace Vehicle Design and Manufacture
Staff Contact: Mr J.R.Page, Dr N.E.A. Ahmed
CP12 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
CP12 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
CP12 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.E.A.Ahmed
CP12 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
CP12 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
CP12 SS HPW3

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

MANF0420
Production Management
Staff Contact: Dr K. Hoang
CP15 S1 HPW6
Note/s: Excluded MANF4420.

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
CP7.5 S1 HPW3
Note/s: Protective equipment (eg safety glasses, safety boots, etc) is required in order to comply with the Occupational Health and Safety Act. Students must already possess or purchase these items before commencing the

course. The price of the items is approximately 100 dollars. Students who have done appropriate Industrial Arts subjects 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 which includes welding, fitting and machining.

MANF1110
Manufacturing Technology
Staff Contact: Dr L.E. Farmer
CP7.5 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: Dr L.E. Farmer
CP10 S1 HPW4
Corequisites: MANF3410, MECH2100, MECH2411

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
CP10 S2 HPW4
Corequisites: MANF3200, MANF3410, MANF3500, MATH2839

The design of workplaces including jigs and fixtures 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
CP5 S1 HPW2
Prerequisite: MECH1500

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
CP10 S1 HPW4
Prerequisites: MANF1110, MATH2839

An introduction to the role of national and international standards in manufacturing, the principle and technology underlying dimensional metrology. The use of statistical methods in the design and analysis of experiments to investigate the performance of manufacturing processes.

MANF3500
Computers in Manufacturing 1
Staff Contact: Prof H. Kaebernick
CP10 S2 HPW4
Prerequisites: ELEC0807, MANF1110, MECH1500

Selection and use of computer-controlled devices such as robots and machine tools 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
CP15 S1 HPW4 S2 HPW2
Prerequisites: MATH2839, MECH1500
Note/s: Excluded MANF4610, MANF9620, MANF9629.

An introduction to the quantitative aspects of decision making and relevant computing tools including: decision theory, data modelling and data base management systems, operations research, spreadsheets, fourth generation languages and decision support systems.

MANF3800
Introduction to Numerical Methods
Staff Contact: Dr I.L.Maclaine-cross
CP4 S2 HPW1.5
Prerequisites: MATH2009, MECH1500
Note/s: Combined degree course students who have taken MATH3101 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 K. Hoang
CP10 F HPW2

Students will work in project teams to perform a complete manufacturing system design and analysis, 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 2
Staff Contact: Dr K.C. Chan
CP10 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
CP5 S1 HPW2
Prerequisite: MANF3400

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
CP5 S1 HPW2
Prerequisite: MANF3410
Note/s: Excluded 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.

MANF4411
Introduction to Total Quality Management
Staff Contact: Prof H. Kaebernick
CP2.5 S2 HPW1
Corequisite: MANF4410
Note/s: Excluded MANF4412, MANF9410.

Introduction to Total Quality Management; strategic quality planning; human resource development and management. Management of process quality; benchmarking; quality standards and accreditation; quality assurance; value added management.

MANF4412
Total Quality Management
Staff Contact: Prof H. Kaebernick
CP5 S2 HPW2
Note/s: Excluded MANF 4411.

Introduction to Total Quality Management; strategic quality planning; human resource development and management. Management of process quality; benchmarking; quality standards and accreditation; quality assurance; value added management. Basic analytical techniques and tools; statistical process control.

MANF4420
Management of Manufacturing Systems
Staff Contact: Dr K. Hoang
CP20 S1 HPW6 S2 HPW2
Prerequisites: MANF3400, MANF3410, MANF3600
Note/s: Excluded MANF0420, 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
CP5 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
CP10 S1 HPW4
Prerequisite: MANF3600
Note/s: Excluded 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.

MANF8544
Concurrent Product and Process Design
Staff Contact: Prof H. Kaebernick/Dr L.E. Farmer
CP12 SS HPW3
Note/s: Excluded MANF9544

Concurrent Engineering approach to the design of products, processes and manufacturing systems. The product development process and the Concurrent Engineering team. Customer focussed design and Quality Function Deployment. Design for Manufacture, Design and Planning for Assembly, Rapid Prototyping. Implementation, organisation and management of Concurrent Engineering.

MANF8560
Computer Integrated Manufacture
Staff Contact: Dr K. Hoang
CP12 SS HPW3
Note/s: Excluded MANF9560

Systems analysis, design and implementation of Computer Integrated Manufacturing (CIM). Components of CIM including Production Planning and Control, CAD in CIM, Computer-Aided Process Planning, integrated maintenance, material handling. Shared CIM and AI in CIM will also be discussed.

MANF8471
Manufacturing Strategy
Staff Contact: A/Prof R.M. Kerr
CP12 SS HPW3

Relation of manufacturing strategy to business strategy, financial strategy and marketing strategy. Technology and process choice; process positioning. Capacity and location decisions: long term capacity strategies, international capacity planning; planning facilities with a region. Global manufacturing and the virtual corporation. Focused manufacturing; continuous improvement and the experience curve. Strategic management of human resources; strategy implementation and change management; linking operational performance to manufacturing strategy.

MANF8340
Factory Automation
Staff Contact: Dr P. Mathew/Prof H. Kaebernick
CP12 SS HPW3

Elements of factory automation such as Flexible Manufacturing Cells and Systems, material handling and warehousing, assembly systems, automated quality control systems, sensors and data acquisition. Cellular manufacturing techniques and layout planning. Simulation and intelligence in manufacturing. Communication networks in a factory environment. Strategies for factory automation.

MANF9010
Project
Staff Contact: Prof H. Kaebernick
CP48
Note/s: The project must be completed in no more than two sessions.

MANF9040
Seminar (Manufacturing)
Staff Contact: Prof H. Kaebernick
CP0

MANF9340
Flexible Manufacturing Systems
Staff Contact: Prof H. Kaebernick
CP12 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
CP12 SS HPW3

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

MANF9410
Total Quality Management
Staff Contact: Dr B. Kayis
CP12 SS HPW3

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
CP12 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 Manufacturing Engineering
Staff Contact: Prof H. Kaebernick
CP12

MANF9492
Special Topic in Manufacturing Engineering
Staff Contact: Prof H. Kaebernick
CP12

MANF9500
Computer Aided Programming for Numerical Control
Staff Contact: Dr P. Mathew
CP12 SS HPW3
Prerequisite: MECH1500 or equivalent

NC systems and manual programming. Computer assisted programming dealing with specific and generalised 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
CP12 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: Prof H. Kaebernick
CP12 SS HPW3
Note/s: Excluded MANF8544.

Life-cycle design of products, principles of design of products, processes and manufacturing systems, design for quality, design for manufacture, design for assembly, organisational aspects of concurrent engineering.

MANF9560
Computer Integrated Manufacturing
Staff Contact: Dr K. Hoang
CP12 SS HPW3
Prerequisite: MANF9543
Note/s: Excluded MANF8560

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
CP12 SS HPW3

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.

MECH0130
Engineering Drawing and Solid Modelling
Staff Contact: Dr R.A. Platfoot
CP10 SS L1 T3
Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

Communication of form and layout of real world objects, solid modelling of objects. Engineering drawing layouts, orthogonal projections, dimensioning, tolerancing and standard drawing symbols, principles of detail design drawings and assembly drawings. Use of computer graphics and production of drawings.

MECH0330
Engineering Mechanics
Staff Contact: Dr C.V. Madhusudana
CP10 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.

MECH0430
Applied Mechanics
Staff Contact: Prof K.P. Byrne
CP7.5 S2 L2 T1
Prerequisites: MECH0330 or MECH1300
Note/s: Excluded MECH1400, MECH2300.

Stress and deformation of mechanical components under axial loading, bending and torsion. Compatibility and thermal strain. Strain energy. Deflections of trusses. Displacement relationships in planar mechanisms.

MECH0440
Engineering Statics
Staff Contact: Dr C.V. Madhusudana
CP7.5 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.

MECH1000
The Engineering Profession
Staff Contact: A/Prof R.B. Frost
CP2.5 S1 HPW1
Prerequisite: HSC mark 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 introduce the engineering profession; to assess abilities in written expression; to develop a consciousness of the importance of written, pictorial and oral expression in engineering life and to begin to develop these skills; to begin to develop an awareness of the professional attitude.

MECH1100
Mechanical Engineering Design 1
Staff Contact: Dr R.A. Platfoot
CP7.5 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. Systematic design techniques from conceptual through embodiment to the detail stage. Problem breakdown, search for solution concepts and decision techniques. Issues for sizing and form of designs, integration with manufacture and assembly. Investment decisions and cost analysis. Specification requirements and group projects.

MECH1110
Graphical Analysis and Communication
Staff Contact: Mr A.J. Barratt
CP7.5 S2 L1 T2
Note/s: Excluded MECH0130.

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: A/Prof R.A.J. Ford
CP10 S1 or S2 L2 T2
Prerequisite: HSC mark 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
Corequisite: MATH1032 or MATH1131 or MATH1042 or MATH1141
Note/s: Excluded MECH0330. Students can make up for the lack of the prerequisite by work taken in Physics in Session 1 of Year 1 and enrol in the subject in Session 2.

Vectors, resultants, equilibrium. Systems of co-planar multiforce members. Mass centre, centroids, distributed forces. Friction. Applications to cables, screw threads, clutches etc. Plane particle kinematics: rectilinear, curvilinear and relative motion. Plane particle kinetics: equations of motion, work, energy, power, impulse, momentum, impact.

MECH1400
Mechanics of Solids 1
Staff Contact: A/Prof R. Randall
CP7.5 S1 or S2 L2 T1
Corequisites: MECH1300 or MECH0330 or MECH0440
Note/s: Excluded MECH0430.

Resultants and equilibrium in three-dimensions; stress and strain; internal forces; stresses, deformation and strain energy due to axial loading, bending and torsion; helical springs.

MECH1500
Computing 1 M
Staff Contact: Dr M.J. Tordon
CP7.5 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.

MECH2000
Preparation for Industrial Training
Staff Contact: Dr K. Hoang
CP0.5 S2 4 hours 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: A/Prof R.B. Frost
CP15 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: A/Prof K.P. Byrne
CP7.5 S1 or S2 L2 T1
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, MECH1300 or MECH0360
Note/s: Excluded MECH0430.

Kinetics of systems of particles; 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. Engineering applications.

MECH2310
Engineering Mechanics 2B
Staff Contact: Prof K.P. Byrne
CP5 S1 or S2 HPW2
Prerequisite: MECH2300

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

MECH2411
Mechanics of Solids 2A
Staff Contact: Dr H.L. Stark
CP7.5 S1 or S2 HPW3
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241
Corequisite: MECH1400
Note/s: Excluded MECH2411

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. Fatigue, stress concentrations, miner's rule. Membrane stresses. Material properties and testing.

MECH2412
Mechanics of Solids 2B
Staff Contact: Dr H.L. Stark
CP7.5 S2 HPW3
Prerequisite: MECH2411
Note/s: Excluded MECH2412

Simple bending, second moment of area of a cross section Ix. Unsymmetrical bending of beams, second moments of area Ix, Iy, Ixy. Principal second moments of area Iu and Iv. Bending of composite beams, reinforced concrete beams. Transverse shear stresses in beams. Shear centre. Combined stresses in beams. Column buckling. Material properties and testing.

MECH2600
Fluid Mechanics 1
Staff Contact: Prof G.L. Morrison
CP10 F L1 T1
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, 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 characteristics.

MECH2700
Thermodynamics 1
Staff Contact: A/Prof E. Leonardi
CP10 F L1 T1
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, 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.

MECH3000
Professional Ethics and Responsibility
Staff Contact: Prof C. Patterson
CP5 S2 HPW2
Prerequisite: MECH2000

Professional ethics, responsibility, liability and intellectual property.Written communication and oral reporting.

MECH3091
Co-operative Training A
Staff Contact: Dr J. Katupitiya
CP0 S1
Prerequisite: Completion of Year 3 of course

Co-op scholars are required to do a 25 week period of industrial training in Session 1 of their Year 4. 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: Dr J. Katupitiya
CP0 S2
Prerequisite: Completion of Year 3 of course

Co-op scholars are required to do a 25 week period of industrial training in Session 2 of their Year 4. 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: Mr A.J. Barratt
CP15 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 M.J. Tordon
CP7.5 F HPW1.5
Prerequisites: ELEC0807, MECH2411, MECH2600, MECH2700

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.

MECH3202
Microprocessor Control
Staff Contact: Dr J. Katupitiya
CP7.5 S2 L2 T1
Prerequisite: ELEC0807
Corequisite: ELEC0808

Microprocessor architecture; introduction to microprocessor programming in assembler and high level languages and specific aspects of programming of a single board (chip) microcomputer; programming concepts. Instruction sets and addressing modes; instruction timing; interrupts. Laboratory complement to lectures based on the use of single board computers.

MECH3211
Linear Systems Analysis
Staff Contact: Dr R. A. Willgoss
CP7.5 S1 L2 T1
Prerequisites: MATH2009, MECH1300
Note/s: Combined degree course students who have taken MATH3181 Optimal Control 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
CP7.5 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 J.E. Baker
CP5 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. Satellite motion. Gyroscopic torque. Kinematics and kinetics of mechanisms.

MECH3310
Vibration Analysis
Staff Contact: Prof C. Patterson
CP5 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: Prof E.J. Hahn
CP10 S1 L3 T1
Prerequisites: MATH2009, MECH2411

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.

MECH3510
Computing Applications in Mechanical Systems
Staff Contact: Dr J. Katupitiya
CP5 S1 HPW2
Prerequisite: MECH1500
Note/s: Excluded MECH4500.

Development of programming skills in the C++ language and their application in mechanical engineering. Object oriented programming for developing software models of mechanical systems such as open kinematic chains. Development of user machine interfaces for instrumentation, interfacing and measurement.

MECH3600
Fluid Mechanics 2
Staff Contact: Dr I.L. Maclaine-cross
CP5 S1 HPW2
Prerequisites: MATH2009, MECH2600, MECH2700

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

MECH3701
Thermodynamics 2
Staff Contact: Prof B.E. Milton
CP5 S2 HPW2
Prerequisite: MECH2700

Availability – open and closed systems; general thermodynamic relations; kinetic theory of gases; non-reactive ideal gas mixtures; combustion.

MECH3702
Heat Transfer
Staff Contact: Prof G.L. Morrison
CP5 S1 HPW2
Corequisite: MECH3600

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
CP7.5 S2 L2 T1
Prerequisites: MATH2009, MECH1500
Note/s: Combined degree course students who have taken MATH2220 Continuous Dynamical Systems or MATH3101 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
CP30 F T6
Corequisite: MECH4001

Thesis is to be taken in the year a course is completed. The subject requires students to demonstrate managerial, technical and professional skills in planning, executing and reporting an approved engineering project within a stipulated time limit. Each student is guided by a supervisor, but successfully completing the project, writing the thesis and submitting two bound copies by specified deadlines are the sole responsibility of each student. Students are also required to present their findings in a thesis conference which is organised under MECH4001 Communications for Professional Engineers.

MECH4001
Communications for Professional Engineers
Staff Contact: Mr P.J. Helmore
CP5 S2 HPW2
Prerequisites: MECH3000
Corequisite: MECH4000, MECH4002

Development of skills in the use of various media of communication. Presenting oral and written reports. Conference organisation and participation. Group projects in communications.

MECH4002
The Engineer in Society
Staff Contact: Dr R.T. Casey
CP5 S2 HPW2
Corequisite: MECH4001

Reading, instruction and project work concerned with the organisational, environmental and social aspects of engineering. The subject is intended to integrate a student's prior and current studies over the range of scientific, technological and contextual areas and general education. Students will undertake socially directed projects in large groups and follow them up with more reflective individual tasks.

MECH4020
Group Engineering Project
Staff Contact: A/Prof M. Behnia
CP15 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: Dr K. Hoang
CP0 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 R.B. Frost
CP15 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: A/Prof R.B. Frost
CP7.5 SS 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
CP7.5 SS L2 T1
Prerequisite: MECH3100
Note/s: Excluded 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
CP7.5 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, boolean operations and solids manipulation. Programming and database interfacing in a CAD environment. Development of engineeering based applications using these facilities.

MECH4150
Design and Maintenance of Components
Staff Contact: Dr R.A. Platfoot
CP7.5 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.

MECH4201
Advanced Digital Logic
Staff Contact: Dr J. Katupitiya
CP7.5 S1 HPW3
Prerequisites: ELEC0807, ELEC0808

Review of number theory; Boolean algebra; basic properties; representation of logical statements; positive and negative truth logic. Use of circuit diagram as a basic tool for design, construction and debugging of problems in logic; mixed symbology. Advanced digital logic techniques; interfacing of digital inputs and outputs in a microprocessor based system. Laboratory complement to lectures based on design and build projects which include design, construction and debugging.

MECH4211
Modelling and Control of Mechatronic Systems
Staff Contact: Dr J. Katupitiya
CP7.5 S2 HPW3
Prerequisite: MECH3212

Introduction to Mechatronics System. Revision of control engineering concepts in the continuous time domain; theory of discrete time control system. z-transform; mathematical modelling of mechatronic systems in z-domain. System identification; model validation techniques; control strategies. Development of control algorithms; computer simulation of control systems; implementation of control algorithms.

MECH4221
Industrial Robotics
Staff Contact: Dr R. A. Willgoss
CP7.5 S1 HPW3
Prerequisites: MECH3200, MECH3212

Automation types; introduction to industrial robots; end effectors. Robotic history, populations and main use; laboratory and PC environments. Kinematics of multidegree of freedom systems; simulation with open systems software. Safety standards; design of installations. Anatomy of an industrial robot as an intelligent machine; robot languages; work cell design. Projects.

MECH4222
Intelligent Machines
Staff Contact: Dr R. A. Willgoss
CP7.5 S1 HPW3
Prerequisites: MECH3200, MECH3212, MECH3510

Language construction and programming environments; object orientation with C++; the node/channel paradigm and OCCAM. Knowledge representation, subsumption architecture, frames and rule based systems. Use of PROLOG - first order predicate logic; LISP - function oriented. Learning: neural nets, Fuzzy logic, genetic algorithms, decision trees. Microprocessor implementation; programming of control examples and operation in the real world.

MECH4223
Machine Condition Monitoring
Staff Contact: A/Prof R. B. Randall
CP7.5 S2 HPW3
Prerequisites: MECH3200, MECH3212

Sensors and transducer interfacing to computers. Vibration signatures of faults in rotating and reciprocating machines; detection and diagnosis of faults; characterisation of signatures; prediction of service life and maintenance procedures. Project on measuring a parameter indicating possible failure.

MECH4300
Mechanics of Manipulators
Staff Contact: A/Prof J.E. Baker
CP7.5 SS L2 T1
Prerequisite: MECH3300

Three-dimensional kinematics and kinetics of a rigid body: co-ordinate transformations, rigid-body motion, Eulerian angles, motion composition, angular acceleration, relative motion, momentum and inertia, work-energy principle, equations of motion, impulse. Screw motor notation. Application to systems of rigid bodies. Spatial linkage analysis.

MECH4301
Plane Mechanism Kinematics
Staff Contact: A/Prof J.E. Baker
CP7.5 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: A/Prof R.B. Randall
CP7.5 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.

MECH4321
Engineering Noise 1
Staff Contact: Dr J.M. Challen
CP7.5 SS HPW3
Note/s: Excluded MECH9325

Development of the acoustic plane wave equation, introduction of 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.

MECH4322
Engineering Noise 2
Staff Contact: Dr J.M. Challen
CP7.5 SS HPW3
Prerequisite: MECH4321 or MECH9325
Note/s: Excluded MECH9326.

The Helmholtz resonator. Transmission line formulae for one dimensional plane wave calculations. 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.

MECH4361
Lubrication
Staff Contact: Prof E.J. Hahn
CP7.5 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
CP7.5 SS L2 T1
Prerequisite: MECH3400
Note/s: Excluded MECH9400.

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
CP7.5 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
CP7.5 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.

MECH4440
Theory of Plasticity
Staff Contact: Dr C.V. Madhusudana
CP7.5 SS L2 T1
Prerequisite: MECH3400

Analysis of stress, strain, strain rate; plastic stress strain relations with description of experimental verification. Application of plasticity theory to a selection of problems including metal working processes such as extrusion and rolling and metallic friction and wear.

MECH4610
Advanced Fluid Dynamics
Staff Contact: A/Prof E. Leonardi
CP7.5 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
CP7.5

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
CP7.5 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: Prof G.L. Morrison
CP7.5 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: A/Prof M. Behnia
CP7.5 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: A/Prof M. Behnia
CP7.5 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
CP7.5 SS HPW3
Corequisite: MECH3702
Note/s: Excluded MECH9751.

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
CP7.5

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
CP7.5 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 optimization; the adjacency matrix.

MECH9010
Project
Staff Contact: Dr C.V. Madhusudana
CP48
Note/s: The project must be completed in no more than two sessions.

MECH9120
Design Technology
Staff Contact: A/Prof R.B.Frost
CP12 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
CP12 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
CP12 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, bodlean operations and solids manipulation. Programming and database interfacing in a CAD environment. Development of engineering based applications using these facilities.

MECH9150
Design and Maintenance of Components
Staff Contact: Dr R.A. Platfoot
CP12 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.

MECH9201
Digital Logic Fundamentals for Mechanical Engineers
Staff Contact: Dr M.J. Tordon
CP12 SS HPW3

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
CP12 SS HPW3
Prerequisite: MECH9201 or equivalent
Note/s: Excluded 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
CP12 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
CP12 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
CP12 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.

MECH9211
Modelling and Control of Mechatronic Systems
Staff Contact: Dr J. Katupitiya
CP12 SS HPW3
Prerequisite: MECH3212 or equivalent

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

MECH9212
Control and Modelling of Mechanical Systems 2
Staff Contact: Dr R.A. Willgoss
CP12 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
CP12 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
CP12 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
CP12 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
CP12 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: A/Prof R.B. Randall
CP12 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: A/Prof R.A.J. Ford
CP12 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: Dr J.M. Challen
CP12 SS HPW3

Fourier coefficients of periodic signals. Power spectral density. Time windows and spectral analysis. Simple sound pressure measurements. Measurement of special descriptors of sound. Measurement of reverberation time and calculation of absorption coefficients. Measurements of the sound power level of a drill by the direct and the comparison method. Measurements of the sound power levels of an electric drill by the intensity method. Tape recording of noise and vibration signals. Using accelerometers.

MECH9323
Environmental Noise
Staff Contact: Prof K.P. Byrne
CP12 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: Prof K.P. Byrne
CP12 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: Dr J.M. Challen
CP12 SS HPW3
Note/s: Excluded MECH4321.

Development of the acoustic plane wave equation, introduction of 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: Dr J.M. Challen
CP12 SS HPW3
Prerequisite: MECH4321 or MECH9325
Note/s: Excluded MECH4322.

The Helmholtz resonator. Transmission line formulae for one dimensional plane wave calculations. 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: Prof E.J. Hahn
CP12 SS HPW3
Note/s: Excluded MECH4361.

Types of hydrodynamic 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.

MECH9400
Mechanics of Fracture and Fatigue
Staff Contact: Dr K. Zarrabi
CP12 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
CP12 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: Dr H.L. Stark
CP12 SS HPW3
Prerequisite: Assumed knowledge MECH3400 or equivalent

Plates, shells: primary, secondary and peak stresses, relations to strength. Pressure vessels. Current design philosophies.

MECH9440
Plasticity Theory and Applications
Staff Contact: Dr C.V. Madhusudana
CP12 SS HPW3
Prerequisite: MECH3400 or equivalent
Note/s: Excluded MECH4440

Analysis of stress, strain, strain rate; plastic stress strain relations with description of exprimental verification. Application of plasticity theory to a selection of problems including metal working processes such as extrusion and rolling and metallic friction and wear. Limit analysis.

MECH9610
Advanced Fluid Dynamics
Staff Contact: A/Prof E. Leonardi
CP12 SS HPW3
Prerequisite: MECH3600 or equivalent
Note/s: Excluded MECH4600, MECH4610, 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 E. Leonardi
CP12 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.

MECH9710
Numerical Fluid Dynamics and Heat Transfer
Staff Contact: A/Prof E. Leonardi
CP12 SS HPW3
Prerequisite: Assumed knowledge MECH3800 or equivalent
Note/s: Excluded MECH4710.

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
CP12 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: A/Prof M. Behnia
CP12 SS HPW3
Prerequisite: Assumed knowledge MECH3701 or equivalent
Note/s: Excluded MECH4730.

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: A/Prof M. Behnia
CP12 SS HPW3
Prerequisite: Assumed knowledge MECH2600 and MECH2700 or equivalent
Note/s: Excluded MECH4740.

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.

MECH9742
Power Production Assessment
Staff Contact: A/Prof M. Behnia
CP12 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.

MECH9750
Industrial Applications of Heat Transfer
Staff Contact: A/Prof M. Behnia
CP12 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
CP12 SS HPW3
Note/s: Excluded MECH4751.

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
CP12 SS HPW3
Prerequisite: Assumed knowledge MECH9751 or equivalent
Note/s: Candidates wishing to specialise 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
CP12 SS HPW3
Prerequisite: Assumed knowledge MECH9730, MECH9751, MECH9752 or equivalent

Design of refrigeration equipment compressors; throttling devices; condensers; evaporators. Cooling towers: evaporative condensers; air conditioning coils. Piping systems. Air ducts. Steam raising and water heating equipment.

MECH9754
Refrigeration and Air Conditioning Design 2
Staff Contact: Dr I.L. Maclaine-cross
CP12 SS HPW3
Prerequisite: MECH9753 or equivalent

Generators and absorbers for absorption systems. 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
CP12 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
CP12 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
CP12 SS HPW3
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
CP12 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
CP12 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
CP12 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.

MECH9920
Special Topic in Mechanical Engineering
CP12 SS HPW3

MECH9930
Special Topic in Mechanical Engineering
CP12 SS HPW3

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

NAVL3100
Principles of Ship Design 1
Staff Contact: A/Prof L.J. Doctors
CP7.5 F HPW1.5
Corequisites: NAVL3600, NAVL3610

Development of ship and ship building. Ocean environment. Trading environment. Ship operations. Ship types. Freeboard. Tonnage. Mathematics of ship design: optimization techniques. Mathematical modelling.

NAVL3400
Ship Structures 1
Staff Contact: Dr M. Chowdhury
CP10 F HPW2
Prerequisites: MATH2009, MATS9520, MECH2412
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. Hull girder vibration-design procedures.

NAVL3600
Ship Hydrostatics
Staff Contact: Mr P.J. Helmore
CP12.5 F L2 T.5
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, 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
CP12.5 F L2 T.5
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 M. Chowdhury
CP5 S2 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: A/Prof L.J. Doctors
CP15 F HPW3
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: A/Prof L.J. Doctors
CP17.5 F HPW3.5
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
CP10 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 longitudinal and transverse ultimate strength analysis of hull module - computer aided design. Design of submarine pressure hulls. Plastic design of beams.

NAVL4700
Ship Propulsion and Systems
Staff Contact: Mr P.J. Helmore
CP20 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 School of Biomedical Engineering

Head of School
Professor Klaus Schindhelm

Administrative Assistant
Rhonwen Cuningham

The Graduate School of 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 is the application of engineering techniques and analysis to problem solving in medicine and the biological sciences. The engineering disciplines embraced within the scope of Biomedical Engineering include: Electrical Engineering, Mechanical Engineering, Computer Engineering and Chemical Engineering. Biomedical Engineering provides a direct input to enhancing the quality and scope of health care through the application of engineering analysis to biological systems and introducing engineering principles to medical and surgical interventions.

The Graduate School of Biomedical Engineering, in conjunction with the School of Mechanical and Manufacturing Engineering, the School of Electrical Engineering and the School of Computer Science and Engineering offers concurrent courses in Mechanical Engineering/Biomedical Engineering **3683** Electrical Engineering/Biomedical Engineering **3727** and in Computer Engineering/Biomedical Engineering **3728**. The concurrent courses allow the completion of a Bachelor of Engineering and a Master of Biomedical Engineering within a 5 year period.

Formal graduate courses in Biomedical Engineering are offered. These are: the Master of Biomedical Engineering **8660**, the Master of Engineering Science in Biomedical Engineering **8665**, and the Graduate Diploma in Biomedical 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**.

Concurrent Degree Programs

The concurrent degree programs are specifically designed for undergraduate students wishing to pursue a career in Biomedical Engineering. These programs allow students to enter an integrated course which provides both the prerequisite engineering education and the specialist Biomedical Engineering training.

Students are expected to perform at a credit level average or better in their first three years to be permitted to progress to the Masters component of a concurrent degree program. Students who at the end of Year 3, do not satisfy the requirements for progression to the Masters component may complete the Bachelor of Engineering. At the completion of the Bachelor of Engineering, students may enrol in the Graduate Diploma in Biomedical Engineering with advanced standing for biomedical subjects previously completed.

Students may elect at any time to revert to the BE in Mechanical Engineering, the BE in Electrical Engineering or the BE in Computer Engineering as appropriate. If, once entering a concurrent degree program, students wish to revert to the normal BE programs they will need to satisfy the requirements for the BE as set out in the relevant sections of this handbook. Since the concurrent degree programs introduce subjects additional to those in the BE, the

student reverting to the normal BE program will require an additional year to achieve a BE after completing years 3 or 4 of the concurrent degree program.

Professional Recognition

The Institution of Engineers, Australia, recognises the Bachelor of Engineering components of the BE/BiomedE courses as meeting the examination requirements for admission to graduate and corporate membership. In addition, examination requirements are met for membership of the Institution's College of Biomedical Engineering and either the College of Electrical or Mechanical Engineering. The degrees are accorded substantial or complete recognition by overseas engineering institutions.

Undergraduate Study

Course Outlines

3683
Mechanical Engineering/Biomedical Engineering - Full-time Course

Bachelor of Engineering Master of Biomedical Engineering
BE MBiomedE

Course 3683 is a concurrent BE in Mechanical Engineering and Master of Biomedical Engineering. The course outline is given below. Subject prerequisites are waived for ANAT2111 and PHPH2112.

Year 1		HPW S1	HPW S2	CP
BIOM1000	Professional Biomedical Studies	1	0	2.5
CHEM1101	Chemistry 1A	0	6	15
MANF1100	Workshop Technology	3	0	7.5
MANF1110	Manufacturing Technology	0	3	7.5
MATH1131 MATH1141	Mathematics 1 A or Higher Mathematics 1A	6	0	15
MATH1231 MATH1241	Mathematics 1B or Higher Mathematics 1B	0	6	15
MECH1000	Professional Studies 1	1	0	2.5
MECH1100	Mechanical Engineering Design 1	1	2	7.5
MECH1110	Graphical Analysis and Communication	0	3	7.5
MECH1300	Engineering Mechanics 1	4	0	10
MECH1400	Mechanics of Solids 1	0	3	7.5
MECH1500	Computing 1M	0	3	7.5
PHYS1918	Physics 1ME	6	0	15

Total HPW Session 1 22
Total HPW Session 2 26
Total Credit Points 120

		HPW S1	HPW S2	CP
Year 2				
ANAT2111	Introductory Anatomy*	6	0	15
MATH2009	Engineering Mathematics 2	4	4	20
MATH2501	Pure Maths. 2 (Linear Algebra)	2.5	2.5	15
MATH2520	Pure Maths. 2 (Complex Analysis)	0	2.5	7.5
MATS9520	Eng. Materials	3	0	7.5
MECH2300	Eng. Mechanics 2A	0	3	7.5
MECH2411	Mechanics of Solids 2A	3	0	7.5
MECH2412	Mechanics of Solids 2B	0	3	7.5
PHPH2112	Physiology 1*	6	6	30
General Education subject/s		2	2	15

Total HPW Session 1 24.5
Total HPW Session 2 25
Total Credit Points 132.5

Year 3				
BIOM9332	Biocompatibility	0	3	12
BIOM9410	Regulatory Requirements of Biomedical Technology	0	3	12
BIOM9561	Mechanical Properties of Biomaterials	3	0	12
ELEC0807	Electrical Engineering 1E	0	3	7.5
ELEC0808	Electrical Engineering 2E	0	3	7.5
MANF3400	Engineering Economics	2	0	5
MATH2839	Statistics SM	3	0	7.5
MECH2000	Professional Studies 2 (4 hrs)			
MECH2100	Mechanical Engineering Design 2	3	3	15
MECH2310	Engineering Mechanics 2B	0	2	5
MECH2600	Fluid Mechanics 1	2	2	10
MECH2700	Thermodynamics 1	2	2	10
MECH3211	Linear Systems Analysis	3	0	7.5
MECH3400	Mechanics of Solids 3	4	0	10
MECH3510	Applications in Mechanical Systems	2	0	5
General Education subject/s		0	4	15

Total HPW Session 1 24
Total HPW Session 2 25
Total Credit Points 142

**Subject prerequisites to be waived*

		HPW S1	HPW S2	CP
Year 4				
BIOM9010	Biomedical Engineering Practice	2	0	8
BIOM9420	Clinical Laboratory Science	3	0	12
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3100	Mechanical Engineering Design 3	3	3	15
MECH3200	Engineering Experimentation	1.5	1.5	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH3300	Engineering Mechanics 3	2	0	5
MECH3310	Vibration Analysis	0	2	5
MECH3600	Fluid Mechanics 2	2	0	5
MECH3701	Thermodynamics 2	0	2	5
MECH3702	Heat Transfer	2	0	5
MECH3800	Numerical Methods	0	3	7.5
Mechanical Engineering Technical Electives		6	6	30
Biomedical Engineering Elective		0	3	7.5

Total HPW Session 1	**21.5**
Total HPW Session 2	**25.5**
Total Credit Points	**125**

Year 5				
BIOM5000	Thesis A	6	6	30
BIOM9006	Thesis B	0	6	24
BIOM9440	Biomedical Practical Measurement	4	0	16
BIOM9541	Mechanics of the Human Body	3	0	12
BIOM9551	Biomechanics of Physical Rehabilitation	3	0	12
MANF4400	Engineering Management	2	0	5
MANF4412	Total Quality Management	0	2	5
MECH4001	Communication for Professional Engineers	0	2	5
MECH4002	The Engineer in Society	0	2	5
MECH4090	Industrial Training	0	0	0
Biomedical Engineering Electives		6	6	30

Total HPW Session 1	**24**
Total HPW Session 2	**24**
Total Credit Points	**144**

Mechanical Engineering Technical Electives

Twelve session hours must be selected in Year 4. It is unlikely that all of the Mechanical Engineering Technical Electives listed below can be offered each year. Those to be made available are decided on the basis of demand and staff availability. Students are advised in September of each year which Technical Electives will be offered in the following year.

		HPW S1	HPW S2	CP
MECH4301	Plane Mechanism Kinematics	3or 3		7.5
MECH4310	Advanced Vibration Analysis	3or 3		7.5
MECH4321	Engineering Noise 1	3	0	7.5
MECH4322	Engineering Noise 2	0	3	7.5
MECH4361	Lubrication	0	3	7.5
MECH4400	Fracture Mechanics	3or 3		7.5
MECH4410	Engineering Applications of Finite Elements	3or 3		7.5
MECH4420	Plates and Shells	3or 3		7.5
Design				
MECH4110	Design Project	3	3	15
MECH4120	Design Technology	3	0	7.5
MECH4130	Computer-Aided Engineering Design	0	3	7.5
MECH4131	Advanced CAD Modelling and Applications	3or 3		7.5
MECH4140	Design Activity: Morphology, Strategies and Tools	3or 3		7.5
MECH4150	Design and Maintenance of Components	3or 3		7.5
MECH4160	Design and Management of Large Systems	3or 3		7.5
Fluid and Thermal Engineering				
MECH4610	Advanced Fluid Dynamics	3or 3		7.5
MECH4690	Special Fluid Mechanics Elective	3or 3		7.5
MECH4700	Turbomachines and Engines	3or 3		7.5
MECH4720	Solar Energy	3or 3		7.5
MECH4730	Multiphase Flow	3or 3		7.5
MECH4740	Thermal Power Plants	3or 3		7.5
MECH4751	Refrigeration and Air Conditioning	3or 3		7.5
MECH4790	Special Thermodynamics Elective	3or 3		7.5
General				
MECH4020	Group Engineering Project	3	3	15
MECH4800	Optimal Engineering Strategies	3	0	7.5

Biomedical Engineering Electives

In Years 4 and 5 electives from the list below need to be selected. All Biomedical Engineering Electives are at the graduate level.

BIOM9027	Medical Imaging**	0	4	16
BIOM9028	Radiation Physics	3	0	12
BIOM9060	Biomedical Systems Analysis	3	0	12
BIOM9311	Mass Transfer in Medicine	0	4	16
BIOM9321	Physiological Fluid Mechanics	4	0	16
BIOM9450	Clinical Information Systems	0	3	12
BIOM9621	Biological Signal Analysis	3	0	12
BIOM9701	Dynamics of the Cardio-vascular System	3	0	12
SAFE9224	Principles of Ergonomics	3	0	12
ANAT3131	Functional Anatomy 1	6	0	15
ANAT3141	Functional Anatomy 2	0	6	15
PATH9003	Principles of Disease Processes	3	0	12

3727
Electrical Engineering/Biomedical Engineering
Full-time Course

Bachelor of Engineering Master of Biomedical Engineering
BE MBiomedE

Course 3727 is a concurrent BE in Electrical Engineering and Master of Biomedical Engineering. The course outline is given below.

		HPW S1	HPW S2	CP
Year 1				
BIOM1000	Professional Biomedical Studies	1	0	2.5
CHEM1806	Chemistry 1EE	3	0	7.5
COMP1011	Computing 1A	0	6	15
ELEC1011	Electrical Engineering 1	6	0	15
ELEC1041	Digital Circuits	0	3	7.5
MATH1131	Mathematics 1A or			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B or			
MATH1241	Higher Mathematics 1B	0	6	15
MATH1090	Discrete Mathematics	0	3	7.5
MATS9520	Engineering Materials	3	0	7.5
PHYS1969	Physics 1	6	6	30
Total HPW Session 1		**25**		
Total HPW Session 2		**24**		
Total Credit Points		**122.5**		

		HPW S1	HPW S2	CP
Year 2				
BIOM9010	Biomedical Engineering Practice	0	2	8
BIOM9410	Regulatory Requirements of Biomedical Technology	0	3	12
COMP1021	Computing 1B	6	0	15
ELEC2030	Circuit Theory	3.5	0	9
ELEC2011	System Theory	0	2.5	6.5
ELEC2015	Electromagnetic Applications	0	2.5	6.5
ELEC2033	Electronics 1	0	4	10
ELEC2041	Microprocessors & Interfacing	4	0	10
MATH2011	Several Variable Calculus	4	0	15
MATH2620	Higher Pure Maths 2 - Complex Analysis	0	2.5	7.5
MATH2849	Statistics EE	0	3	9
MATH3150	Transform Methods	0	2	7.5
PHYS2949	Physics 2E (Electrical Engineering)	6	0	15
General Education subject/s		0	4	15
Total HPW Session 1		**23.5**		
Total HPW Session 2		**25.5**		
Total Credit Points		**146**		

		HPW S1	HPW S2	CP
Year 3				
BIOM9430	Electromedical Standards	3	0	12
ELEC2042	Real Time Instrumentation	0	4	10
ELEC3004	Signal Processing 1	4	0	10
ELEC3005	Electrical Energy 1	4	0	10
ELEC3006	Electronics 2	5	0	12.5
ELEC3014	Systems and Control 1	0	4	10
ELEC3017	Electrical Engineering Design	0	5	12.5
MATH2501	Linear Algebra	2.5	2.5	15
MATH3141	Mathematical Methods EE	0	4	10
PHPH2112	Physiology 1*	6	6	30
Total HPW Session 1		**24.5**		
Total HPW Session 2		**25.5**		
Total Credit Points		**132**		

		HPW S1	HPW S2	CP
Year 4				
BIOM9420	Clinical Laboratory Science	3	0	12
BIOM9028	Radiation Physics	0	3	12
BIOM5910	Thesis Part A	0	6	15
ELEC3013	Communication Systems 1	0	4	10
ELEC3041	Real Time Engineering	2.5	0	10
ELEC4010	Introduction to Management for Electrical Engineers	4	0	12
ELEC4011	Ethics and Electrical Engineering Practice	0	2	6
ELEC4483	Biomedical, Instrumentation, Measurement and Design	0	4	12
ELEC4412	System & Control 2	4	0	12
ELEC4903	Industrial Training	0	0	0
General Education subject/s		4	0	15
Technical Electives		6	6	48
Total HPW Session 1		**25**		
Total HPW Session 2		**25**		
Total Credit Points		**164**		

		HPW S1	HPW S2	CP
Year 5				
BIOM5911	Thesis Part B	12	0	30
BIOM5812	Thesis Part C	0	9	36
BIOM9027	Medical Imaging	0	4	16
BIOM9060	Biomedical Systems Analysis	0	3	12
BIOM9440	Biomedical Practical Measurement	4	0	16
ELEC4042	Signal Processing 2	4	0	12
Technical Electives		3	9	48
Total HPW Session 1		**23**		
Total HPW Session 2		**25**		
Total Credit Points		**170**		

**Subject prerequisite to be waived*

Technical Electives for Course 3727
In Years 4 and 5 electives totalling 24 session hours need to be selected from the list below. At least 2 subjects should be selected from the Electrical Engineering Electives. All Biomedical Engineering Electives are at the graduate level.

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. 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.

Biomedical Engineering Electives		HPW S1	HPW S2	CP
BIOM9311	Mass Transfer in Medicine	4	0	16
BIOM9332	Biocompatibility	3	0	12
BIOM9450	Clinical Information Systems	3	0	12
BIOM9510	Introductory Biomechanics	3	0	12
BIOM9701	Dynamics of the Cardio-vascular System	3	0	12
PATH9003	Principles of Disease Processes	3	0	12
Electrical Engineering Technical Electives				
ELEC9342	Signal Processing 2: Advanced Techniques	0	3	12
ELEC9370	Digital Image Processing Systems	0	3	12
ELEC9405	Human Movement Control Systems	0	3	12
ELEC9407	Cybernetic Engineering	0	3	12
ELEC9412	Biological Signal Analysis	0	3	12
ELEC9416	Non-linear Systems and Simulation	0	3	12
ELEC4351	Data Networks 1	4	0	12

3728
Computer Engineering/Biomedical Engineering - Full-time Course

Bachelor of Engineering Master of Biomedical Engineering
BE MBiomedE

Course 3728 is a concurrent BE in Computer Engineering and Master of Biomedical Engineering. The course outline is given below.

Year 1		HPW S1	HPW S2	CP
BIOM1000	Professional Biomedical Studies	1	0	2.5
BIOM9010	Biomedical Engineering Practice	0	2	8
COMP1011	Computing 1A	6	0	15
COMP1021	Computing 1B	0	6	15
ELEC1011	Electrical Engineering 1	6	0	15
MATH1131	Mathematics 1A or			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B or			
MATH1241	Higher Mathematics 1B	0	6	15
MATH1090	Discrete Mathematics	0	3	7.5
PHYS1969	Physics 1	6	6	30

Total HPW Session 1 25
Total HPW Session 2 23
Total Credit Points 123

Year 2		HPW S1	HPW S2	CP
CHEM1806	Chemistry 1EE	3	0	7.5
BIOM9028	Radiation Physics	0	3	12
BIOM9410	Regulatory Requirements of Biomedical Technology	0	3	12
COMP2011	Data Organization	5	0	15
COMP2021	Digital System Structures	5	0	15
COMP2031	Concurrent Computing	0	5	15
ELEC2011	Systems Theory	0	2.5	6.5
ELEC2030	Circuit Theory	3.5	0	9
ELEC2033	Electronics 1	0	4	10
MATH2510	Real Analysis or			
MATH2610	Higher Real Analysis	2.5	0	7.5
MATH2520	Complex Analysis or			
MATH2620	Higher Complex Analysis	2.5	0	7.5
MATH2849	Statistics EE	0	3	9
MATH3150	Transform Methods	0	2	7.5
PHYS2959	Introductory Semiconductor Physics	1.5	0	5
General Education Elective(s)		2	2	15

Total HPW Session 1 25
Total HPW Session 2 24.5
Total Credit Points 153.5

Year 3				
ANAT2111	Introductory Anatomy*	6	0	15
BIOM9027	Medical Imaging	0	4	16
BIOM9332	Biocompatibility	0	3	12
BIOM9060	Biomedical Systems Analysis	0	3	12
COMP0001	Total Quality Management	0	3	7.5
COMP3211	Computer Organisation and Design	4	0	15
COMP3221	Microprocessors and Interfacing	0	5	15
ELEC3006	Electronics 2	5	0	12.5
ELEC3004	Signal Processing 1	4	0	10
MATH2501	Linear Algebra or			
MATH2601	Higher Linear Algebra	5	0	15
MATH3141	Mathematical Methods	0	4	10
General Education Elective(s)		2	2	15

Total HPW Session 1 26
Total HPW Session 2 24
Total Credit Points 155

Year 4				
BIOM5920	Thesis A	0	7	17.5
BIOM9440	Biomedical Practical Measurement	4	0	16
COMP3111	Software Engineering	0	5	15
COMP3121	Algorithms and Programming Techniques	5	0	15
COMP3231	Operating Systems	5	0	15
COMP3331	Computer Networks and Applications	0	5	15
COMP4903	Industrial Training	0	0	
ELEC3014	Systems and Control 1	5	0	
PHPH2112	Physiology 1*	6	6	30
Biomedical Electives		0	3	12

Total HPW Session 1 25
Total HPW Session 2 26
Total Credit Points 150.5

		HPW S1	HPW S2	CP
Year 5				
BIOM5921	Thesis B	14	0	**35**
COMP3411	Artificial Intelligence	5	0	**15**
COMP4012	Image and Vision Computing	0	4	**10**
BIOM9420	Clinical Laboratory Science	3	0	**12**
BIOM9922	Masters Thesis	0	6	**24**
IROB2721	Managing People	4	0	**15**
Biomedical Electives		6	6	**48**
Computing Electives		5	5	**30**

Total HPW Session 1 **34**
Total HPW Session 2 **21**
Total Credit Points **177**

**Subject prerequisite to be waived*

Electives for Course 3728

In Year 5 electives totalling 78 credit points or greater need to be selected from the list below. At least 30 credit points should be selected from the Computer Engineering Electives. All Biomedical Engineering Electives are at the graduate level.

The program selected by each student must be approved by the Head of School. Not all electives are offered each session. Students are advised each year of the timetable of available electives. It may be possible to substitute other electives run by the Schools of Electrical or Computer Engineering, apart from those listed above. Substitution is not permitted if it unduly restricts the range of subjects studied to only one area.

Biomedical Engineering Electives			
BIOM9311	Mass Transfer in Medicine	4	**16**
BIOM9321	Physiological Fluid Mechanics	4	**16**
BIOM9332	Biocompatibility	3	**12**
BIOM9450	Clinical Information Systems	3	**12**
BIOM9510	Introductory Biomechanics	3	**12**
BIOM9603	Image and Flow Cytometry	3	**12**
BIOM9621	Biological Signal Analysis	3	**12**
BIOM9701	Dynamics of the Cardiovascular System	3	**12**
PATH9003	Principles of Disease Processes	3	**12**
Computer Engineering Electives			
COMP4211	Advanced Architecture and Design	4	**10**
COMP4411	Artificial Intelligence: Knowledge-Based Systems	4	**10**
COMP4444	Neural Networks	4	**10**
ELEC4042	Signal Processing	4	**12**
ELEC9370	Digital Image Processing Systems	3	**12**
ELEC9405	Human Movement Control Systems	3	**12**
ELEC9416	Non-linear Systems and Simulation	3	**12**
ELEC3013	CommunicationsSystems1	4	**10**
ELEC3016	Electronics 3	4	**10**

Graduate Study

Formal graduate courses in Biomedical Engineering are offered. These are: the Master of Biomedical Engineering **8660**, the Master of Engineering Science in Biomedical Engineering **8665**, and the Graduate Diploma in Biomedical 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 Work Programs

8660
Master of Biomedical Engineering

MBiomedE

The MBiomedE degree course is designed to cater for students with either a medical/biological science or engineering/physical science background.

Initially, students with a medical/biological science 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 240 credit points, 160 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 sessions (part-time) from the date of enrolment. The maximum period of candidature is eight academic sessions (full-time) and ten academic sessions (part-time). In special cases extensions may be granted. A candidate is not permitted to continue in the course if the credit point value of the subjects failed totals more than 48.

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 subjects from other areas may be undertaken subject to the approval of the Head of School. The 72 credit

point Project Report is compulsory and may be undertaken concurrently with other subjects.

Session 1		Notes	CP
Strand A Subjects, Engineering/Physical Sciences Candidates			
ANAT2111	Introductory Anatomy	HR	15
PHPH2112	Physiology 1 (1 full year)	C	30
Strand B Subjects, Medical/Life Sciences Candidates			
BIOM9040	Analogue Electronics for Biomedical Engineers		16
BIOM9101	Mathematical Modelling for Biomedical Engineers	C	16
BIOM9501	Computing for Biomedical Engineers	C	16
General Subjects			
BIOM9060	Biomedical Systems Analysis		12
BIOM9510	Introductory Biomechanics (1)		12
BIOM9551	Biomechanics of Physical Rehabilitation		12
BIOM9601	Biomedical Applications of Microcomputers 1	12	
BIOM9621	Biological Signal Analysis		12
BIOM9701	Dynamics of the Cardiovascular System		12
ELEC9411	Introductory Physiology for Engineers	P	12
Session 2			
General Subjects			
BIOM9010	Biomedical Engineering Practice	C	8
BIOM9012	Biomedical Statistics		12
BIOM9018	Project Report	C	72
BIOM9027	Medical Imaging		16
BIOM9028	Radiation Physics		12
BIOM9050	Microprocessors and Circuit Design for Biomedical Engineers		16
BIOM9311	Mass Transfer in Medicine		16
BIOM9321	Physiological Fluid Mechanics		16
BIOM9332	Biocompatibility		12
BIOM9541	Mechanics of the Human Body		12
BIOM9561	Mechanical Properties of Biomaterials		12
BIOM9602	Biomedical Applications of Microcomputers 2		12
BIOM9603	Image and Flow Cytometry		12
BIOM9612	Medical Instrumentation		20

Notes:

C *Compulsory*

HR *Highly recommended*

P *Part-time students only*

1 *For students with no mechanics background*

8665
Master of Engineering Science

MEngSc

Candidates are required to complete a course totalling at least 120 credit points composed of graduate level subjects, including a 48 credit point project. Entry is for Engineering graduates only.

Individual study programs, generally selected from the subjects listed below, are to be approved by the Head of School or his nominee. Although appropriate graduate level subjects may be taken from other schools within the University a minimum of half the coursework credit points (i.e. 36 credit points) are to be selected from subjects offered by the Graduate School of 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		Notes	CP
BIOM9060	Biomedical Systems Analysis		12
BIOM9510	Introductory Biomechanics	(1)	12
BIOM9551	Biomechanics of Physical Rehabilitation	(2)	12
BIOM9601	Biomedical Applications of Microcomputers 1	(3)	12
BIOM9621	Biological Signal Analysis		12
BIOM9701	Dynamics of the Cardio-vascular System		12
ELEC9411	Introductory Physiology for Engineers	(4)	12
Session 2			
BIOM9010	Biomedical Engineering Practice	(4)	8
BIOM9012	Biomedical Statistics		16
BIOM9027	Medical Imaging	(5)	16
BIOM9028	Radiation Physics		12
BIOM9311	Mass Transfer in Medicine		16
BIOM9321	Physiological Fluid Mechanics		16
BIOM9332	Biocompatibility		12
BIOM9541	Mechanics of the Human Body	(2)	16
BIOM9561	Mechanical Properties of Biomaterials	(2)	12
BIOM9602	Biomedical Applications of Microcomputers II	(6)	12
BIOM9603	Image and Flow Cytometry		12
BIOM9612	Medical Instrumentation		20
BIOM9912	Project Report	(7)(8)	48

Notes:

1. *For students with no mechanics background*

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.*

4. *Highly Recommended for 8665 MEngSc students*

5. *Assumed knowledge/prerequisite BIOM9028*

6. *Subject follows on from BIOM9601.*

7. *Research project may be done concurrently with course work during the other sessions.*

8. *Compulsory*

5445
Graduate Diploma in Biomedical Engineering
GradDip

Details of the recommended programs of study, totalling at least 96 credit points, may be obtained from the Head of the Graduate School of Biomedical Engineering. Subjects from the Masters programs can be taken in the Graduate Diploma program subject to the approval of the course coordinators.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order. Descriptions of subjects being offered in Mechanical, Electrical or Computer Engineering appear in the chapters associated with the School of Mechanical and Manufacturing Engineering, the School of Electrical Engineering or the School of Computer Science and Engineering. For academic advice regarding a particular subject, consult the contact person for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

BIOM1000
Professional Biomedical Studies
Staff Contact: Prof K. Schindhelm
CP2.5 SS L1

Provides an introduction to biomedical engineering; examines the range of professional engineering activities; highlights ethical considerations associated with clinical applications; and develops skill in oral, written and graphical communication.

BIOM5000
Thesis A
Staff Contact: Prof K. Schindhelm
CP30 F HPW6

For BE(Mech)/MBiomedE students only. To be taken in the year of completing the BE(Mech)/MBiomedE degree course.

BIOM5910
Thesis A
Staff Contact: Prof K. Schindhelm
CP15 S2 HPW6
For BE(Elec)/MBiomedE students only.

BIOM5911
Thesis B
Staff Contact: Prof K. Schindhelm
CP30 S1 HPW12
For BE(Elec)/MBiomedE students only.

BIOM9006
Thesis B
Staff Contact: Prof K. Schindhelm
CP15 S2 HPW6

For BE(Mech)/MBiomedE students only. To be taken in the year of completion of the BE(Mech)/MBiomedE degree course. A thesis is to be submitted at the end of the 14th week of the final session which reports the work of both BIOM5000 Thesis A and BIOM5001 Thesis B.

BIOM9010
Biomedical Engineering Practice
Staff Contact: Prof K. Schindhelm
CP8 SS 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. Visits to various biomedical engineering units.

BIOM9012
Biomedical Statistics
Staff Contact: Dr R. Odell
CP16 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
CP72
Note/s: Compulsory for all MBiomedE students.

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

BIOM9027
Medical Imaging
Staff Contact: A/Prof C.D. Bertram
CP16 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 and Positron Emission Tomography, Ultrasound, Diagnostic Radiology, Magnetic Resonance. Clinical application of each area.

BIOM9028
Radiation Physics
Staff Contact: A/Prof B.K. Milthorpe
CP12 S1 L2 T1

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. Radiotherapy. Medical uses of non-ionising electro-magnetic radiation.

BIOM9040
Analogue Electronics for Biomedical Engineers
Staff Contact: Dr B.K. Milthorpe
CP16 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
CP16 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
CP12 S1 L2 T1
Corequisite: BIOM9101 or equivalent
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
CP16 S1 L3 T1
Note/s: Compulsory for Strand B students. This subject is also for students with 1 year university maths or 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
CP16 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
CP16 S2 L2 T2

Fluid mechanics of unsteady flow. 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. Emphasis on physical rather than mathematical understanding of the relevant phenomena, to allow realistic appraisal of the nature of flow in a given organ.

BIOM9332
Biocompatibility
Staff Contact: Dr L. Poole-Warren
CP12 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.

BIOM9410
Regulatory Requirements of Biomedical Technology.
Staff Contact: Dr L. Poole-Warren
CP12 S2 L2 T1

The regulatory requirements of medical devices in Australia, Japan, North America and Europe will be reviewed. Data collation and documentation methods are examined, case studies of medical device registration will be presented.

BIOM9420
Clinical Laboratory Science
Staff Contact: A/Prof B. K. Milthorpe
CP12 S1 L2 T1

The technologies, tests and operation of a variety of clinical laboratories (biochemistry, haematology, immunology, histology). Engineering solutions to the automation of chemical and biochemical assays, design and development of instrumentation, limitations of automated systems. Data recording, tracking and validation. Routes to innovation in a clinical laboratory.

BIOM9430
Electromedical Standards
Staff Contact: Dr A. P. Avolio
CP12 S2 L2 T1

Basic effects of electricity on the human body, threshold of ventricular fibrillation, termination of leakage currents, statistical basis of experimental data used to define limits of leakage currents. Formation of safety standards for electromedical equipment. Mechanisms of approval of electromedical equipment. Acceptance testing procedures. Certification schemes for electromedical equipment. National and international legal requirements.

BIOM9440
Biomedical Practical Measurement
Staff Contact: Dr N. Lovell
CP16 S1 L2 T2

Hands-on practice in the use and testing of medical transducers and electromedical equipment in common use in hospitals and research laboratories to make measurements of biomedical variables of clinical significance.

BIOM9450
Clinical Information Systems
Staff Contact: Dr N. Lovell
CP12 S2 L2 T1

Healthcare information and communications, including telemedicine, medical informatics, networks and privacy. Data collection, medical coding and classification. Standards for medical data interchange. Aspects of database design, client/server topologies.

BIOM9501
Computing for Biomedical Engineers
Staff Contact: Prof K. Schindhelm
CP16 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 PASCAL language. Introduction to C.

BIOM9510
Introductory Biomechanics
Staff Contact: Prof K. Schindhelm
CP12 S1 L2 T1

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: School Office
CP12 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: School Office
CP12 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: A/Prof B.K. Milthorpe
CP12 SS L2 T1
Prerequisite: BIOM9510 or equivalent

The physical properties of materials having significance to biomedical engineering; human tissues; skin; soft tissues; bone; metals; polymers and ceramics. The effects of degradation and corrosion.

BIOM9601
Biomedical Applications of Microcomputers 1
Staff Contact: Dr A. Avolio
CP12 S1 L3
Prerequisites: BIOM9040 and BIOM9050 or equivalents.
Note/s: 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
CP12 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
CP12 S2 L3
Note/s: Basic electronics/computing background required. Subject not offered in 1997.

Technology, techniques and uses of flow and image cytometry. Flow and cytometers (analysis and cell sorting), image analysis and cell counting from slides. Preparation and staining of cells. Data acquisition and analysis. Applications in medical research and diagnosis.

BIOM9612
Medical Instrumentation
Staff Contact: A/Prof C.D. Bertram/ Dr A. Avolio
CP20 S2 L4 T1
Prerequisite: BIOM9040 or equivalent

A critical comparative survey of the theoretical physics and practical applications of medical transducers and electromedical equipment in common use in hospitals and research laboratories. How to choose a measurement device for a given situation. Includes laboratory practicals.

BIOM9621
Biological Signal Analysis
Staff Contact: A/Prof C.D.Bertram
CP12 S1 L1 T2
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
CP12 S1 L2 T1
Note/s: Some mathematics background desirable.

Structure of the heart; organisation of the mammalian vasculature; mechanical, electrical and metabolic aspects of cardiac pumping; the solid and fluid mechanics of blood vessels; rheology of blood.

BIOM9812
Thesis C
Staff Contact: Prof K. Schindhelm
CP36 S2 HPW9

For BE(Elec)/MBiomedE students only. This comprises the third session of the thesis component for the BE(Elec)/MBiomedE degree course. Each student is required to submit a final thesis on their overall project (BIOM5910 Thesis A, BIOM5911 Thesis B and BIOM9812 Thesis C) by the Tuesday of the fourteenth week of the session.

BIOM9912
Project Report
CP48
Note/s: Compulsory for MEngSc students.

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

Graduate School of Engineering

Head of School
Professor C. Patterson

Senior Administrative Officer
Mr G.J. Harris

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 provide professional engineers and other technical professionals with advanced technical 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 organisations. It is, in effect, learning through working-organised study with the opportunity to draw on examples from leading experts. The program should become an integral component of training strategies used by organisations 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 skills 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 it 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 may 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, and may be granted advanced standing in subjects not already taken for an award. 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. In order to fulfil the aims of the program candidates are normally expected to already have substantial industry experience. The subjects in the Program are full-fee paying.

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 a minimum of 120 credit points. A candidate may do a project equivalent to 24, 36, or 48 credit points and the balance may be taken from the following subjects:

Subjects		CP
GSOE9101	Project Management	12
GSOE9102	Management of Manufacturing Systems	24
GSOE9103	Environmental Management	12
GSOE9104	Management of Innovation and Technological Change	12
GSOE9105	Risk Management	12
GSOE9106	Information Systems Management	12
GSOE9107	Maintenance Management	12
GSOE9109	Energy Management	12
GSOE9110	Management of Human Resources	12
GSOE9111	Organisation for Total Quality Management	12
GSOE9112	Managing Occupational Health and Safety	12
GSOE9113	Strategic Management of Business and Technology	12
GSOE9114	Marketing for Technical Managers	12

or other subjects as may be approved by the Head of School.

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. A candidate in appropriate cases may be granted advanced standing for similar work already completed but not used for another award, and may be permitted to count subjects from other courses up to a limit not exceeding one third of the MBT Program. Each study subject is based on open learning principles and a 12 credit point rating is expected to involve the candidate in a total work load equivalent to some 9 hours per week of study for a 14 week session.

The subjects in the Program are full-fee paying.

5457
Graduate Diploma in Industrial Management
GradDipIndMngt

Candidates must complete a minimum program totalling 96 credit points taken from MBT subjects or such other subjects as may be approved by the Head of School. Those successfully completing all 96 credit points may elect to graduate with the Graduate Diploma in Industrial Management or if they wish to proceed to the Masters, contact the Head of School.

The Graduate Diploma in Industrial Management is based on open learning principles. 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.

The subjects in the Program are full-fee paying.

Both the MBT and the GradDipIndMngt may also be undertaken by distance learning.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organisational 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
Co-ordinator: Prof David Carmichael
CP12

Project Management involves the overall planning, control and co-ordination of a project. It is the process by which the responsibility for all phases is combined within one multi-disciplinary function.

This subject introduces you to the project management skills needed during the lifetime of a project by working through a chronological model.

GSOE9102
Management of Manufacturing Systems
Co-ordinator: A/Prof Roger Kerr
CP24

Presents an integrated and coherent account of new production management philosophies to give you a sound basis in the modern principles and techniques of the manufacturing industry.

There is strong emphasis on strategic perspectives of manufacturing, the relationship between manufacturing and business strategies, and the implications of a given manufacturing strategy for detailed manufacturing management decisions, plans, policies and performance measures.

GSOE9103
Environmental Management
Co-ordinator: A/Prof Ronnie Harding
CP12

Gives you an overview of the range of environment issues facing our community. By understanding the big picture you will be able to make sound economic decisions without losing your commitment to a sustainable environment.

The more specific issues and control strategies discussed will give you new insights into environmental control techniques and methods for handling environmental problems, ranging from legal aspects to quantitative risk assessment.

GSOE9104
Management of Innovation and Technological Change
Co-ordinator: Dr James Carlopio
CP12

The world in which we live and the organisations in which we work are now best viewed as systems in which everything, everywhere, truly affects everything else. This subject provides you with the opportunity of learning some new tools and some new ways of thinking that are better suited to addressing the complex problems and opportunities inherent in our organisations today.

GSOE9105
Risk Management
Co-ordinator: Prof Jean Cross
CP12

Enables you to identify, predict and manage the risks involved in engineering and technology projects through risk analysis and quantification and the use of probability and statistics. The effect of risk on financial, technical and legal outcomes of projects is examined. Also covered are risk management techniques, including: decision analysis, sensitivity analysis, forecasting and other quantitative methods, as well as insurance and occupational health and safety aspects.

GSOE9106
Information Systems Management
Co-ordinator: Mr Geoffrey Dick
CP12

Addresses the need for information management, covering: Organisations and implementation of engineering and technological projects; uses and abuses of information technology; traditional and future ways of acquiring, generating, preparing, organising and disseminating information; analysis, design implementation (software and hardware).

GSOE9107
Maintenance Management
Co-ordinator: Dr Robin Platfoot
CP12

Covers the following topics: maintenance policies and strategies; cost and productivity; equipment failure and reliability; repair and damage control; inspection and preventive maintenance programs; monitoring and measurement; failure characteristics of plant and equipment; systems engineering approaches; optimum decision making; the introduction of change to the workplace and risk management.

GSOE9109
Energy Management
Co-ordinator: A/Prof Geoffrey D. Sergeant
CP12

Gives you an understanding of energy flows in the community, the choices of energy forms available now and possible in the future, and how to manage the selection and utilisation of the various energy forms in industry and commerce.

GSOE9110
Management of Human Resources
Co-ordinator: Prof David Carmichael
CP12

Develops your skills and thinking in human resource management, particularly as they apply to engineering and technological situations, including projects. You will be looking at the roles and responsibilities, interrelationships, people skills, the use of people's time and the personnel management function. An important aspect is the recognition of people as the basic unit of engineering productivity, which also involves taking into account the structure and function of organisations, interpersonal skills, conflict management, motivation and related issues.

GSOE9111
Organisations for Total Quality Management
Co-ordinator: A/Prof Peter Gibson
CP12

Examines the central role that a commitment to quality can play in improving the productivity and competitive position of an Organisations. The key issues and techniques of quality management, and the skills needed to implement and consolidate TQM improvements, are investigated.

GSOE9112
Managing Occupational Health and Safety
Co-ordinator: Prof John Toohey
CP12

Workplace injury involves organistions in insurable costs (workers' compensation premium) and uninsurable costs (productivity losses, low morale, reputation damage, equipment losses and downtime). This subject concentrates on the prevention of workplace injury and associated costs and losses through the application of effective management systems. Industry case studies are used, as are analysis and application of management techniques.

GSOE9113
Strategic Management of Business and Technology
Co-ordinator: Dr Peter Gibson
CP12

Introduction, competitive posture, market structure, key success factors, competitive advantage, generic strategies. Strategic business units, strategy documentation, strategic choice and risk. Analytical approaches to strategy development, strategic design principles. Classic approaches; Machiavelli, Sun Tzu, Clautsewitz and relevance to business strategy. Strategic choice. Diversification, corporatisation of public utilities, strategic alliances, mergers and acquisitions.

Implementation of strategy. Organisation, centralisation and devolution options. Process re-engineering. Taught largely by case study, syndicate work and debate. Typical cases: Shell, Electrolux, Colgate Palmolive, Coca-Cola Amatil, Boral Ltd, Body Shop, New Corporation, Virgin Group, Education Industry, Electricity Industry, Motor Industry, Brewing Industry.

GSOE9114
Marketing for Technical Managers
Co-ordinator: Dr Chris Dubelaar
CP12

Introduction to marketing - definitions of marketing and the customer emphasis; marketing planning, its role and purpose; the environment and how to monitor it; market segmentation - what, why and how; customer behaviour; organisational marketing and behaviour product design; product pricing; product place; product promotion; other marketing applications; marketing strategy.

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 specialised 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 eight Centres either located within relevant Schools or in association with other Faculties.

Centre for Advanced Numerical Computation in Engineering and Science
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

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

Administrative Offier
Ms L. Suhartono

The Centre for Advanced Numerical Computation in Engineering and Science (CANCES) is a specialist research centre and 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 coursework and research programs, carries out both fundamental and applied research through developing and using computer codes, provides short courses for industry-based engineers and scientists and organises 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.

The Centre has its own subject identifier (ANCE).In addition to the majors the Centre offers in Civil Engineering and Mechanical Engineering, it offers a Graduate Diploma in Computational Science and a Master of Computational Science. Further information on course structure and subject descriptions can be found in the Faculty of Science Handbook or from the CANCES Office.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organisational 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.

ANCE8001
Computational Mathematics
Staff Contact: CANCES
CP12 S1 HPW3

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

ANCE8002
Supercomputing Techniques
Staff Contact: CANCES
CP12 SS HPW3

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

ANCE8101
Data Analysis and Visualisation
Staff Contact: CANCES
CP12 SS HPW3

Statistical data analysis, error assessment, spectral analysis and data filtering, recent development in data analysis techniques. Topics also include data storage, organisation and formats. Graphic analysis of real data sets and graphic packages for data visualisation.

ANCE8102
Mesh Generation
Staff Contact: CANCES
CP12 SS HPW3

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

ANCE8103
Fundamental Applied Computation
Staff Contact: CANCES
CP12 SS HPW3

Computational skills for candidates with limited previous training, structured to provide an appropriate foundation for the core subjects. Equivalent to the FACES program (self contained computer-based learning modules for industry-based engineers and scientists.

ANCE8202
Physics and Modelling of Atmospheric Boundary Layers
CP12 SS HPW3

Theory of atmospheric boundary layer flows; numerical modelling of turbulence and flow over complex terrain; Boundary layer parameterization; dispersion of pollutants and particles.

ANCE9105
Computational Techniques for Fluid Dynamics
Staff Contact: CANCES
CP12 SS HPW3

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

Centre for Manufacturing and Automation

Director:
Dr S.S. Leong

The Centre for Manufacturing and Automation was established within the School of Mechanical and Manufacturing Engineering in 1986 to undertake research leading to technological developments and improvements in the applications of advanced technology in the Australian manufacturing industry. The Centre promotes technology exchange between UNSW and industry and runs continuing education programs for managers, engineers and other professionals to assist them in maintaining their technological knowledge and managerial skills. The Centre provides support for multidisciplinary undergraduate and postgraduate courses, offered by the School of Mechanical and Manufacturing Engineering.

Centre for Remote Sensing and Geographic Information Systems

Director:
Professor B.C. Forster

The Centre is a joint multidisciplinary enterprise of the Faculty of Applied Science and the Faculty of Engineering aimed at facilitating research in the broad area of spatial information systems, which include remote sensing, geographical information systems and land information systems. It maintains a remotely sensed and geographical information system data repository.

Research interests include applications of artificial intelligence in remote sensing, neural networks in remote sensing, satellite mapping of bushfires, and vegetation mapping from remote sensing images. Other interests include monitoring urban areas using high resolution satellite remotely sensed data and spatial information systems for road based transport planning, evaluation and design. Applications using radar form a core interest of the Centre.

There are more than 30 academic staff associated with the Centre. Active links are maintained with researchers in Asia, North America, China and Europe.

The Centre offers undergraduate and postgraduate teaching and research in remote sensing and geographical

information systems. The Centre also offers short courses on remote sensing and geographical information systems to the wider community.

Graduate Programs in Geographic Information Systems

The Master of Applied Science in Geographic Information Systems **8027.1000** is offered in both Geography and Geology within the Faculty of Applied Science. Entry into either discipline depends on the background of the applicant and the orientation of the proposed program. Detailed information on this course is listed under the School of Geography section in the Applied Science handbook.

The Masters degree program is also offered in the Faculty of Engineering as a Master of Engineering Science **8652**. This course has a stronger engineering bias.

Graduate Programs in Remote Sensing

The graduate programs in Remote Sensing are offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either Faculty depends on the background of the applicant and the orientation of the proposed program.

Programs are available leading to the award of:

Faculty of Applied Science
Master of Applied Science in Remote Sensing **8047.2000**
Graduate Diploma in Remote Sensing **5047.2000**

Faculty of Engineering
Master of Engineering Science in Remote Sensing **8641**
Graduate Diploma in Remote Sensing **5496**

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 Schools of Geography and Geology in the Faculty of Applied Science and the School of Geomatic Engineering 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:
Associate Professor B. Shackel

The Munro Centre for Civil and Environmental Engineering was established in the School of Civil Engineering in 1992. Its purpose is to support the School, and to facilitate interaction between the School, the engineering profession, industry and government. The Centre promotes ongoing education in civil and environmental engineering by organising conferences, courses and seminars.

Photovoltaics Special Research Centre

Director:
Professor M. A. Green

The Photovoltaics Special Research Centre was established in 1991 under the Australian Research Council's Research Centres Program. Its function is to carry out research into improved performance, lower cost photovoltaic solar cells and develop a co-ordinate set of activities in the photovoltaic systems area. The Centre offers programs and facilities for postgraduate and postdoctoral research and is housed in the School of Electrical Engineering

UNSW Groundwater Centre

Director:
Dr J. A. Jankowski

The UNSW Groundwater Centre was created in 1987 and is a joint enterprise of the Faculties of Engineering and Applied Science. The Centre's facilities are based at the Water Research Laboratory in Manly Vale and in the Department of Applied Geology.

The Centre organises a Masters course in Groundwater Studies, as well as undergraduate and PhD training. The Masters course is completed full-time over a period of twelve months and offers specialisations in contaminant hydrogeology and groundwater resource development. Students from Iran, Canada, UK, Zambia, Malaysia, Thailand, Indonesia, and Botswana have studied at the Centre in recent years, as well as many Australian students.

The staff at the Centre work closely with the Cooperative Research Centre for Waste Management and Pollution Control to develop geophysical techniques for mapping dense non-aqueous phase liquid contamination of unconsolidated aquifer formations. This work has involved the development of new sample acquisition and recovery techniques and the development of integrated hydrogeochemical and geophysical laboratories at the Water Research Laboratory.

Major research interests include the development of hydrogeochemical and biogeochemical models for the occurrence of dry land salinity; the characterisation of flow in fractured aquifers using a combination of isotope techniques; and the assessment of airborne multispectral scanner and airborne radar for the mapping of aquifer recharge and discharge areas.

The Centre offers specialised graduate courses in Groundwater Studies and carries out general teaching in Hydrogeology to Applied Science and Engineering postgraduate students.

Information on the centre's courses is listed under the School of Civil Engineering section in this handbook or the School of Mines, Department of Applied Geology section in the Faculty of Applied Science handbook. The following programs are available.

8021
Master of Applied Science in Groundwater Studies

The Master of Applied Science degree is undertaken through the Department of Applied Geology in the Faculty of Applied Science.

8614 (External) 8612.5100 (Internal)
Master of Engineering Science in Waste Management

The Master of Engineering Science degree is undertaken through the School of Civil Engineering in the Faculty of Engineering.

5458
Waste Management Graduate Diploma

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 organisational 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.

ACCT5917
Strategic Management: Systems and Processes
Staff Contact: School Office
S1 L3 CP20

This subject explores the process and practice of strategic management - the constitution of an organisation's competitive positioning in its environment. Topics to be covered include: strategic thinking and analysis; the formulation and choice of strategic alternatives; managing extended strategic change; and the embedding of organisation al strategy in everyday activities. These topics are explored through a critical examination of relevant literatures, documented case studies and contemporary business practices.

ACCT9001
Introduction to Accounting A
Staff Contact: School Office
S1 L1.5 CP7.5

This subject introduces non-commerce students to the nature, purpose and conceptual foundation of accounting: information systems including accounting applications, and analysis and use of accounting reports.

ACCT9002
Introduction to Accounting B
Staff Contact: School Office
S2 L1.5 CP7.5
Prerequisite: ACCT9001

This subject 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 CP10

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.

ANAT2111
Introductory Anatomy
Staff Contact: Dr P. Pandey
CP15 F HPW6

Prerequisites: BIOS1101, BIOS1201 Introduction to gross anatomy, based on a study of prosected specimens. Musculoskeletal, cardiovascular, respiratory, gastrointestinal, genitourinary and nervous systems. General topographical and surface anatomy.

ANAT2211
Histology 1
Staff Contact: Dr A.Ansselin
CP15 F HPW3
Prerequisites: BIOS1101, BIOS1201
Corequisite: ANAT2111

Theory and practical aspects of modern histological techniques. Basic histology, including the morphological and functional properties of epithelial, connective, muscle and nervous tissues. Systematic histology, including a histological examination of the major systems of the body; cardiovascular, respiratory, lymphatic, integumentary, digestive, endocrine, urinary, reproductive and nervous (including eye and ear) systems. Emphasis on the ability to interpret histological sections and selected electron micrographs of mammalian tissues and organs and to relate morphology to tissue and organ function.

ANAT3131
Functional Anatomy 1
Staff Contact: Prof D. Tracey
CP15 S1 HPW6
Prerequisite: ANAT2111

Functional anatomy of the musculoskeletal system in the head, neck and upper limb, includes biomechanics of connective tissue; in particular bone, cartilage and tendon. Tutorials involve study of prosected specimens, X-rays and surface anatomy; students will also carry out their own dissections of the upper limb.

ANAT3141
Functional Anatomy 2
Staff Contact: Prof D. Tracey
CP 15 S2 HPW6
Prerequisite: ANAT3131

Functional anatomy of the musculoskeletal system in the trunk and lower limb. Includes functional aspects of muscle and a discussion of the mechanics and energetics of walking and running. Tutorials involve study of prosected specimens, X-rays and surface anatomy; students will also carry out their own dissections of the lower limb.

BIOS1201
Molecules, Cells and Genes
Staff Contact; Dr ML Augee
CP15 S1 HPW6
Prerequisites: HSC Exam Score Required: 2 unit Science (Physics) 53-100, or 2 unit Science (Chemistry) 53-100, or 2 unit Science (Geology) 53-100, or 2 unit Science (Biology) 53-100, or 3 unit Science 90-150, or 4 unit Science 1-50.
Excluded: BIOS1011 and BIOS1301.
Note/s: Prerequisites for BIOS1201 are minimal (and may be waived on application to the Director) Practical and tutorial seat assignments must be obtained at the Biology Enrolment Centre on the day of enrolment. The course guide is available for purchase during enrolment week. Equipment required for practical classes is listed in the Course Guide and must be purchased before session starts. Students must consult if for details of the course and assessments. The subject is concerned with the basic characteristics of life. The chemistry of life is covered with emphasis on the way in which living things construct and break down macromolecules. The way in which the genetic code controls these processes depends to a great extent on the structure and function of cell components, and cell biology is a major component of the subject. The final topic is genetics - the way in which the genetic code is inherited and the ways in which it can be modified.

CEIC0010
Mass Transfer and Material Balances
Staff Contact: A/Prof M Brungs
CP10 F L1 T1
Prerequisites: CHEM1101, CHEM1201, CIVL2505
Note/s: Servicing subject i.e. a subject taught within courses offered by other faculties.

Mechanisms and models of mass transfer at fixed and free interfaces. Diffusion. Convection. Adsorption. Phase equilibria. Calculation of mass transfer rates at surfaces with simple geometry. Mass transfer in dispersions. Applications of material balances to process calculations in chemical operations. Conventions in methods of analysis and measurement. Stoichiometry. Process calculations associated with gases and liquids. Problems involving bypass, recycle and purge. Differential material balances. Energy balances. Environmental engineering applications.

CEIC0020
Fluid/Solid Separation
Staff Contact: A/Prof JA Raper
CP5 SS L1 T1
Note/s: Servicing subject i.e. a subject taught within courses offered by other faculties.

Particle Characterisation: Size analysis, sphericity, surface area, density. Fluid-particle Interactions: Drag coefficient, effect of Reynolds number. Terminal velocity, effect of shape, concentration. Drops and bubbles. Particle-particle interactions including flocculation. Flow through porous media. Darcy, Carmen-Kozeny, Ergun equations. 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
CP15 S1 L1 T1 S2 L2 T2
Prerequisites: CEIC0010, INDC4120
Note/s: Servicing subject i.e. a subject taught within courses offered by other faculties

The course comprises four components:

Process safety
Reliability. Failure rate. Series, parallel and redundant systems. Hazard and operability studies (HAZOP). Risk criteria. Fault treee analysis. Quantitative risk assessment. Pressure and explosion relief. Laboratory safety.

Industrial air pollution control
Ventilation. Gas cleaning. Inertial collection. Fabric filtration. Wet scrubbing. Electrostatic precipitation. Removal of pollutant gases. Choice of gas cleaning equipment.

Industrial waste treatment
Clean technology. Air pollution. Industrial water pollution control Membrane technology. Waste minimisation. Site remediation. Odour monitoring laboratory. Catalyst technology. Invited lectures. Industry visit. Report writing. Presentation of reports. Case studies.

Analysis of pollutants
Laboratory-based component, covering the principal methods used for environmental trace analysis. Gas chromatography. Liquid chromatography. Visible, UV and IR spectrophotometry. Atomic emission and absorption spectrophotometry.

CEIC0040
Unit Operations in the Process Industries
Staff Contact: Dr PT Crisp
CP10 S1 L2 S2 T2
Prerequisites: CHEM1101, CHEM1201, PHYS1989, CEIC0010
Note/s: Servicing subject, i.e. a subject taught within courses offered by other faculties.

Heat transfer. Heat exchangers. Condensors, evaporators, boilers. Heating and refrigeration units Gas absorption towers. Distillation. Liquid-liquid extraction processes. Tower equipment. Size reduction. Crushers, grinders, cutters. Filtration. Batch, continuous and clarifying filters. Tank, evaporator and vacuum crystallisers. Dryers and their selection. Particle theory. Sedimentation. Industrial settlers and cyclones. Packed beds. Fluidisation. Sampling of particles. Particle size analysis. Porosity and density measurement. Adsorption. Laboratory visits.

CEIC0050
Atmospheric and Process Chemistry
Staff Contact: Dr PT Crisp
CP7.5 S1 L2 T1
Prerequisites: CHEM1101, CHEM1201
Note/s: Servicing subject, i.e. a subject taught within courses offered by other faculties.

Provides essential chemistry for understanding the processes which are responsible for air pollution. Composition and structure of the atmosphere. Natural gas chemistry. Free-radical gas-phase chemistry. Sources, transformation and sinks for atmospheric gases. Combustion processes. Smog chemistry. Radiochemistry. Biochemistry of toxic chemicals. Chemistry of polluting processes.

CHEM1101
Chemistry 1A
Staff Contact: Dr P Chia
CP15 S1 or S2 HPW6
Prerequisites: HSC Mark Range Required: 2 unit Mathematics 60-100, or 3 unit Mathematics 1-50, or 4 unit Mathematics 1-100 and 2 unit Chemistry 65-100, or 3 unit Science 90-150, or 4 unit Science 1-200, or 2 unit Physics 75-100, CHEM1401 60 or higher.

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.

CHEM1201
Chemistry 1B
Staff Contact: Dr P Chia
CP15 S2 or Summer Session HPW6
Prerequisite: CHEM1101
Note/s: Students who require CHEM1101 and CHEM1201 but have not undertaken chemistry at HSC Level should take CHEM1401 before proceeding to CHEM1101. However, no more than 30 Credit Points of Chemistry at Level I may be counted towards a Science degree.

Molecular Geometry, hybridization of Orbitals. Periodicity of Physical and Chemical Properties of Chemical compounds. Organic Chemistry including Stereoisomerism.

CHEM1800
Chemistry 1EP
Staff Contact: Dr P Chia
CP7.5 S1 HPW3
Prerequisites: HSC Exam Mark range required: 2 unit Mathematics 60-100, or 3 unit Mathematics 1-50, or 4 unit Mathematics 1-100 and 2 unit Science (Physics) 57-100, or 2 unit Science (Chemistry) 60-100, or 3 unit Science 90-150, or 4 unit Science 1-200
Note/s: Restricted to program 0176 of Course 3985

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

CHEM1806
Chemistry 1EE
Staff Contact: Dr P Chia
CP7.5 S1 HPW3
Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 60-100, or 3 unit Mathematics 1-50, or 4 unit Mathematics 1-100 and 2 unit Science (Physics) 57-100, or 2 unit Science (Chemistry) 60-100, or 3 unit Science 90-150, or 4 unit Science 1-200
Note/s: Restricted to Courses 3640 and 3725

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

CHEM1808
Chemistry 1CE
Staff Contact: Dr P Chia
CP15 S2 HPW6
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, electrochemistry and corrosion. Colloids and clays. Colligative properties of solutions. Organic chemistry, polymers. Applications of chemical principles to engineering.

CHEM2011
Physical Chemistry
Staff Contact: Prof RF Howe
CP15 S1 or S2 HPW6
Prerequisites: CHEM1101, CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241 or 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.

CHEM2031
Inorganic Chemistry and Structure
Staff Contact: Dr N Duffy
CP15 S1 or S2 HPW6
Prerequisites: CHEM1101, CHEM1201

Experimental basis for theories of electronic structure 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 M Mulholland
CP15 S1 or S2 HPW6
Prerequisites: CHEM1101, CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241 or 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.

CHEM3311
Environmental Chemistry
Staff Contact: Prof R Howe
CP15 S2 HPW6
Prerequisites: CHEM2011, CHEM2041 Physical chemistry of the environment. The chemistry of water in the environment; rivers, estuaries and oceans. The chemistry of the atmosphere: photolysis, primary and secondary pollutants. The distribution of elements in ecosystems. Analysis of naturally occurring species and pollutants.

GEOG2021
Introduction to Remote Sensing
Staff Contact: Mr A Evans
CP15 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.

GEOG2051
Soils and Landforms
Staff Contact: Dr W Erskine, Mr J Sammut
CP15 S1 L2 T2
Prerequisite: GEOG1031 or GEOG1073

An introduction to soil classification schemes with particular emphasis on the soils and landforms of flood-plains and the Riverine Plain, NSW. Long term development of landscapes with emphasis on the evolution of mountain ranges. Arid zone and coastal landforms emphasising current processes and Quaternary history.

GEOG3011
Pedology
Staff Contact: A/Prof M Melville
CP15 S1 L2 T2
Prerequisites: GEOG1073 and one of CHEM1101 or CHEM1401 or both GEOL1101 and GEOL1201 or both BIOS1011 and BIOS1021

Methodology of pedogenic studies and the application of these studies to the understanding of soil and form 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.

GEOG3032
Remote Sensing Applications
Staff Contact: Mr A Evans
CP15 S1 L2 T2
Prerequisite: GEOG2021 or GMAT8711

Spectral characteristics of natural phenomena and image formation. Ground truthing, collection and calibration. Introduction to computer classification procedures. Multi-temporal 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: Dr W Erskine
CP15 S1 L2 T2
Prerequisites: GEOG1031 or GEOG1073 or by permission from Head of School

Rationale and basic objectives; history and legislative framework: standardised 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 EIAs.

GEOG3062
Environmental Change
Staff Contact: School Office
CP15 S1 L2 T2
Prerequisite: Successful completion of a Year 2 Program 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, Mr J Sammut
CP15 S1 L2 T2
Prerequisite: GEOG1073 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, salinisation and soil fertility decline; and habitat loss and fragmentation.

GEOG4300
Vegetation management
Staff Contact: A/Prof M Fox
CP15 S1 L2 T2
Prerequisite: Completion of Stage 3 of a four-year degree program.
Note/s: Contact hours include some fieldwork which forms a compulsory part of this subject. Students will incur some personal costs for fieldwork.

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.

GEOG9150
Remote Sensing Applications
Staff Contact: Mr A Evans
CP12 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; multi-temporal 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
CP12 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. MapInfo is used for cartographic manipulation and output.

GEOG9240
Principles of Geographic Information Systems
Staff Contact: Dr Q Zhou
CP12 S1 L1 T2

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 ARCINFO and MAP for spatial data manipulation and display.

GEOG9241
Advanced Geographical Information Systems
Staff Contact: School Office
CP12 S2 L1 T2
Prerequisite: GEOG9240

Advanced topics and concepts in GIS research and development. Focus is primarily on vector-based systems. Topics include data models, structures and capture; vector editing and algorithms; errors and data accuracy. Practical exercises based on ARCINFO; INFO is used for data base management.

GEOG9280
Application and Management of Geographical Information Systems
Staff Contact: Prof B Garner, Dr Q Zhou
CP12 S1 L2 T1

The process and issues involved in an organisation acquiring, implementing and managing a GIS will be considered using real examples. Applications using GIS in the management of natural resources (forest, park, soil etc), human activities at the local, national and global scale will be critically reviewed. The course will involve the practical use of project management tools.

GEOG9290
Image Analysis of Remote Sensing
Staff Contact: Mr A Evans
CP12 S2 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.

GEOL0360
Remote Sensing Applications in Geoscience
Staff Contact: A/Prof GR Taylor
CP12 SS L2 T1

The physics of various remote sensing techniques. Consideration of various sources of imagery; Landsat, TM, SPOT, aircraft scanners etc. Spectral properties of rocks, soils and vegetation. Geological applications of visible, infrared, thermal and multi-parameter microwave imagery in resource exploration, tectonic studies, geological hazard recognition and environmental monitoring. Mapping and data integration methodologies.

GEOL9010
Groundwater Environments
Staff Contact: Dr J Jankowski
CP12 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 aquifer 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.

GEOL9030
Geological Engineering
Staff Contact: Mr GH McNally
CP12 S1

Geomechanical properties of intact rock, discontinuities and rock masses. Weathering processes and geotechnical consequences. Mechanical excavation and blasting. Rock support for shallow underground structures. Dam

engineering, dam site geology, embankment zoning, foundation treatment and grouting, materials selection and specification. Foundation engineering.

GEOL9051
Hydrogeochemistry
Staff Contact: Dr J Jankowski
CP12 S1

Chemical composition of natural and contaminated groundwaters; inorganic parameters in natural waters; methods of expressing concentration and representation of hydrochemical data; interpretation of chemical analyses, chemical types of waters; aqueous geochemistry, chemical thermodynamics, activities of ionic species, equilibrium reactions, non-equilibrium approaches, the carbonate system and pH control; chemical weathering, water-rock interactions; clay minerals and ion exchange, silicate equilibria, mass balance, oxidation and reduction, redox equilibria, redox processes and reactions. Application of physical chemistry to groundwater systems. Geochemical evolution of groundwater. Introduction to hydrochemical modelling. Introduction to isotope studies; case studies in natural and polluted environments.

GEOL9060
Environmental Geology
Staff Contact: Mr GH McNally
CP12 S1 L3

Geology and urban planning; geological input to Environmental Impact Statements; soil and rock construction materials; ground subsidence due to mining and groundwater pumping; geological hazards; land degradation and problem soils; engineering geomorphology.

GEOL9110
Hydro and Environmental Geology
Staff Contact: Dr I Acworth
CP7.5 S2 L2 T1
Prerequisite: GEOL5100
Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Hydrogeology: determination of intrinsic permeability in field and laboratory, tracer tests, finite difference modelling methods applied to groundwater flow, drilling methods for unconsolidate and consolidated deposits, piezometer design and installation, remote sensing methods for contaminated groundwater investigations, sampling methods.

Hydrogeochemistry: Chemical composition of natural and contaminated groundwater, inorganic parameters in groundwaters, chemical types of groundwaters, chemical reactions and processes, chemical evolution and chemical classification of groundwaters, chemical equilibrium, disequilibrium, acid-base chemistry, the carbonate system and pH control, oxidation and reduction.

GEOL9120
Groundwater Contaminant Transport
Staff Contact: Dr J Jankowski
CP7.5 S1 L2 T1
Prerequisites: GEOL9110
Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Weathering reactions and geochemical processes, ion exchange, salt sieving and brine development, dryland salinity, fresh water - saline water interaction, application of stable and radioactive isotopes in groundwater studies, groundwater microbiology, corrosion and incrustation in groundwater bores, practical field and laboratory measurements, monitoring and sampling of contaminants in groundwater, sources and types of contaminants, groundwater quality and environmental standards, contaminant mass transport in groundwater - chemical dispersion, chemical diffusion and retardation, Kd - test, hydrogeochemical modelling, physical and empirical models, modelling of subsurface transport, trace metals in groundwater - speciation and transport, restoration and clean-up.

INDC3070
Instrumentation and Process Control 1
Staff Contact: Dr C Dixon
CP7.5 S2 L2 T1
Prerequisites: MATH2021, CEIC2010, CEIC2020

Analog Computation: theory and application of basic analog computing elements; magnitude and time scaling; solution of linear differential equations. Instrumentation: theory and application of transducers and transmitters for measurement of process variables. Process Dynamics: behaviour of linear, lumped parameter dynamics systems; first, second and higher order and integrating systems. Process Control closed loop, block diagrams, controllers and controller tuning.

INDC4120
Chemistry of the Industrial Environment
Staff Contact: Dr PT Crisp
CP7.5 S1 L2 T1
Prerequisites: CHEM1101, CHEM1201

Soil chemistry. Occupational diseases. Smogs and acid rain. Toxic elements and compounds. Toxic waste disposal. Industrial accidents. Atmospheric structure and chemistry. Greenhouse warming. The Ozone hole. Nuclear energy. Alternative energy sources. Water analysis. Air analysis. Occupational health.

INFS1611
Requirements Engineering
Staff Contact: School Office
S1 HPW 1.5 CP7.5

This half subject trains students how to define system requirements using rapid prototyping techniques. requirements elicitation, analysis and traceability methods are addressed, with emphasis on the roles of user interface design and object-oriented techniques. Students receive hands-on experience with an automated design tool.

INFS2603
Systems Analysis & Design
Staff Contact: School Office
S2 HPW 3 CP15
Prerequisites: INFS1603

This subject examines system analysis and design: requirements analysis and specification; logical and physical design of business systems; students compare design methodologies such as structures and object oriented.

INFS2607
Business Data Networks
Staff Contact: School Office
S2 HPW 3 CP15
Prerequisite: INFS1602
Note/s: Excluded INFS3607. Replaced INFS3607 in 1996.

Data communication concepts and computer networks, reference to international standards and common industry communications software packages; local/metropolitan/ wide area networks; network management; Telstra services and other options; data security.

INFS3603
Executive Support Systems
Staff Contact: School Office
S1 HPW 3 CP15
Prerequisites: INFS1602 and INFS1603

This subject examines the process of decision making and work group activity by professional and managerial people; the tools and techniques available in information technology to support these processes; the cultural and organisational issues involved in formalizing support; and management issues related to support.

INFS3604
Information Function Management
Staff Contact: School Office
S2 HPW 3 CP15
Prerequisite: INFS2603

This subject introduces the strategic and operational management issues involving information systems and software. Consideration is given to both quantitative management techniques, including practical application of tools and concepts for software project management, as well as material on software metrics and software quality. In addition, techniques are covered for strategic planning of information systems and ensuring business contribution.

INFS3608
Advanced Database Systems
Staff Contact: School Office
S1 HPW 3 CP15
Prerequisites: INFS1602 and INFS1603

Topics include: advanced data analysis and modelling techniques; database management system architectures including hierarchical, network and relational approaches; database reliability, security and integrity issues; and data description and manipulation languages.

INFS4811
Knowledge Based Information Systems
Staff Contact: School Office
S2 HPW 3 CP15

Prerequisites: Admission to BCom degree course at Honours level majoring in Information Systems plus approval of the Head of School of Information Systems. As for INFS5927.

INFS5927
Knowledge Based Information Systems
Staff Contact: School Office
S2 L3 CP20
Prerequisite: INFS5957

This subject reviews concepts, theory, methodologies and techniques discussed in the KBS literature, and reviews current practice. Topics include an historical perspective of AI, expert systems and knowledge based systems, KBS tools and techniques, knowledge acquisition and representation, development methodologies, and evaluation, as well as considering KBS applications and the organisation. Students will design and develop a knowledge based system and present their designs to the class.

INFS5991
Decision Support Systems
Staff Contact: School Office
S1 L3 CP20
Prerequisite: INFS5988

Information used for decision making and the application of information technology to assist or support the decision making process. Topics include decision making models, the impact of different management styles, the use of decision tools and the development of decision support systems including issues of model management and interface design. Practical examples of decision support.

IROB2721
Managing People
Staff Contact: Dr A. Donovan
S1 L2 T2 CP15

This subject focuses on managing in a rapidly changing environment. Topics include: leadership, decision-making and innovation; power, legitimacy, and the socialization process; the structure and design of organisations, organisation and domination, the evolution of ethical awareness; intergroup conflict and conflict resolution; skills of managing - communication, negotiation, coaching and objectives setting; organisational culture and transformation.

LIBS0815
Economics of Information Systems
Staff Contact: To be advised
CP15 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 Retrieval Systems
Staff Contact: Dr Connie Wilson
CP15 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.

LAWS1010
Litigation
Staff Contact: A/Prof Jill Hunter
CP30 F HPW4

Introduces students to issues and problems in three areas: Civil pre-trial procedure: focuses on selected topics largely in the context of Supreme Court - actions parties to an action; pleadings; 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 also addressed with particular reference to case-flow management techniques and alternative dispute resolution. Criminal pre-trial procedure: the law and related issues associated with arrest, warrants, police searches, interrogation and the formulation of pleadings. Comparisons are drawn between the civil and criminal pre-trial processes. Evidence: a basic understanding of the legal and philosophical principles relating to the presentation of evidence in court. The Evidence Acts 1995 (Clth) and (NSW) form the basis of the course. A comprehensive examination of the rules of evidence, including those designed to protect the accused at trial; the rule against hearsay evidence; the use of expert evidence; the treatment of unreliable evidence; proof and probability theory and questioning of witnesses in court. The effect of pretrial procedures on the final outcome at trial highlighted.

LAWS1120
Legal System Torts
Staff Contact: Mr Angus Corbett/Ms Prue Vines
CP30 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. A number of torts, both intentional and unintentional, relating to economic interests as well as personal injury. The primary focus of the course is a thorough and comprehensive introduction to the tort of negligence. There is a detailed discussion of specific issues such as recovery for personal injury, for nervous shock, for pure economic loss as well as affirmative duties of care. In addition there is an introduction to the law relating to limitation periods, vicarious liability, defences to the tort of negligence and the law relating to the assessment of damages. The approach to teaching this material is via extensive discussion of a relatively limited number of leading cases. Students are thus able to build up an understanding of this body of law through their own analysis of case law and statute law. A second strand of this course is to introduce students to the wide ranging debates about the appropriate role and function of tort law. This requires developing a working knowledge of a feminist and economic analysis of tort law and of the various corrective justice theories of tort. In developing this working knowledge students will be exposed to secondary materials which build upon and refer to the cases and statues which are included in the course.

LAWS1420
Contracts
Staff Contact: Mr Denis Harley
CP22.5 F HPW S1 2, S2 4
Note/s: Taken concurrently with LAWS2140 as a composite subject.

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 or 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
CP30 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.

LAWS2140
Public Law
Staff Contact: Mr Robert Shelly
CP7.5 S1 HPW2
Note/s: Taken concurrently with LAWS1420 as a composite subject.

This course introduces the students to the concept of 'public law', its methods of reasoning, history and fundamental principles. It deals with the fundamental principles of constitutional and administrative law, with the ethical precepts underlying our constitutional system; with the essential features of our system of government, and with the increasing role of public international law. The course also introduces students to comparative law, especially the public law assumptions of the Civil Law system. Topics

include the concept of public law; theories and history of constitutionalism; comparative methods of enforcing constitutional precepts; Australia's constitutional development; the separation of powers, responsible government and constitutional conventions; and the republicanism debate.

LAWS2150
Federal Constitutional Law
Staff Contact: Prof George Winterton / Mr Keven Booker
CP15 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, inconsistency of Commonwealth and State laws, freedom of interstate trade and commerce, excise and implied limitations on Commonwealth and State powers, including implied rights. Techniques and approaches adopted by the High Court in interpreting the Australian Constitution. Further study of constitutional law may be undertaken in LAWS2100 The High Court of Australia.

LAWS2160
Administrative Law
Staff Contact: Ms Melinda Jones
CP15 S1 or S2 HPW4

This course considers the law concerning the accountability and control of government officials. Topics covered include: 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].

LAWS3010
Property and Equity
Staff Contact: A/Prof Chris Rossiter
CP30 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: School Office
CP15 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, 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). Litigation and alternative dispute resolution techniques are examined. Attention is also given 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 bodies 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.

LAWS4010
Business Associations 1
Staff Contact: Mr Angus Corbett
CP15 SS HPW4

An introduction to a number of important legal and theoretical aspects of the operation of business corporations. In addition, there is a brief overview of partnership law.
The corporate law component of the subject falls into two parts. The first deals with the process and incidents of incorporation, including the derivation of the modern corporation and an introduction to regulatory structures; an introduction to the corporate constitution, organs and capital; the separate personality of the corporation and its exceptions.
The balance of the subject is concerned with the structure and governance of the corporation. It examines the corporate organs (the board of directors and the general meeting) and the division of corporate powers between them; the duties and liabilities of directors and other officers; the remedies available to shareholders for the enforcement of directors' duties and protection against oppression or overreaching by controllers.
While much of this legal doctrine is equally applicable to the large corporation as to the small enterprise, the subject stresses the problems, processes and transactions typically encountered by small incorporated businesses.

LAWS6210
Law, Lawyers and Society
Staff Contact: Dr Stan Ross
CP15 S1 or S2 HPW4

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.

LAWS7410
Legal Research and Writing 1
Staff Contact: Ms Irene Nemes
CP10 S1 HPW2

The literature, both legal and non-legal, relevant to the law in Australia. The contents of a law library, how it works and is ordered and how lawyers go about using it to find the law. Practice in handling the principal legal materials in the law library, notably law reports, collections of statutes, bibliographies, periodical indexes, digests and material on law reform. An introduction to case analysis and statutes. Principles of legal writing, including plain English, citation practice, word processing and logical argument. An introduction to the use of computerized legal research methods. The methods and objectives of legal and empirical research.

LAWS7420
Legal Research and Writing 2
Staff Contact: Ms Irene Nemes
CP5 S2 HPW2

A revision of legal research skills acquired in LAWS7410 Legal Research and Writing 1, particularly the use of Australian digests, law reform materials, loose-leaf services and legal encyclopaedias. Practice in finding and updating the law on a topic. Foreign Legal systems and International law. Further instruction on the use of computers for retrieval of legal materials.

LAWS7430
Research Component
Staff Contact: Faculty Office
Note/s: Taken after LAWS7420.

Legal Research and Writing Research skills are an essential and integral part of legal practice. There are many opportunities within the courses offered by the Faculty to develop these skills - formally (Legal Research and Writing 1 & 2) and informally (research projects incorporated in the assessment of various subjects). However, to ensure that all students are capable of demonstrating, by application to an actual research project, a thorough knowledge of the research resources, materials and techniques the Faculty has resolved that every student must satisfactorily complete a research essay that is worth 30% or more of the subject requirements in at least one elective subject. This resolution is satisfied by the compulsory subject Research Component.
All elective subjects offered in the Law School are prima facie available to Research Component students for this purpose. However, an elective subject will only qualify for this purpose if it requires a piece of assessable work which constitutes no less than 30% of the total mark. Students must submit a Research Component Form to one of the Student Services Officers by the end of Week 4 in the Session in which they elect to undertake Research Component. This form must identify the elective subject in which the student is currently enrolled and in which the work for Research Component will be satisfied. The assessment of Research Component, on a pass/fail basis, will be based on the satisfactory completion of the nominated piece of assessment. Although there is no formal teaching in Research Component and no credit points are awarded for it, all students must demonstrate that they have satisfactorily completed the subject before they can be cleared for graduation. For further details students should ask for the Information Sheet available at the Faculty Office.

LAWS8320
Legal Theory
Staff Contact: Prof Martin Krygier
CP15 S1 or S2 HPW4

Introduction to philosophical questions which underline the practical workings of the law. The course concentrates on questions to do with legal 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: Prof Martin Krygier
CP15 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 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.

MATH1081
Discrete Mathematics
Staff Contact: School of Mathematics First Year Office
CP15 S1 or S2 HPW6
Prerequisite: As for MATH1131.
Corequisites: MATH1032 or MATH1042 or MATH1131 or MATH1141
Note/s: Excluded MATH1090.

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. 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
CP7.5 S2 HPW3
Corequisite: MATH1032 or MATH1042 or MATH1131 or MATH1141
Note/s: Excluded MATH1081.

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.

MATH1131
Mathematics 1A
Staff Contact: School of Mathematics First Year Office
CP15 S1 or S2 HPW6
Prerequisites: HSC mark range required: 2 unit Mathematics (90-100) or 2 and 3 unit Mathematics (100-150) or 3 and 4 unit Mathematics (100-200) or MATH1011 (these ranges may vary from year to year). 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.
Note/s: Excluded MATH1011, MATH1032, MATH1042, MATH1141, ECON2200, ECON2201, ECON2202, ECON1201, ECON2290, ECON2291.

Complex numbers, vectors and vector geometry, linear equations, matrices and matrix algebra, determinants. Functions, limits, continuity and differentiability, integration, polar coordinates, logarithms and exponentials, hyperbolic functions, functions of several variables. Introduction to computing and the Maple symbolic algebra package.

MATH1141
Higher Mathematics 1A
Staff Contact: School of Mathematics First Year Office
CP15 S1 HPW6
Prerequisites: HSC mark range required: 2 and 3 unit Mathematics (145-150) or 3 and 4 unit Mathematics (186-200) (these ranges may vary from year to year.)
Note/s: Excluded MATH1011, MATH1032, MATH1042, MATH1131, ECON2200, ECON2201, ECON2202, ECON1201, ECON2290, ECON2291.

As for MATH1131 but in greater depth.

MATH1231
Mathematics 1B
Staff Contact: School of Mathematics First Year Office
CP15 S2 HPW6 or Summer Session HPW9
Prerequisite: MATH1131 or MATH1141
Note/s: Excluded MATH1021, MATH1032, MATH1042, MATH1241, ECON2200, ECON2201, ECON2202, ECON1201, ECON2290, ECON2291.

Vector spaces, linear transformations, eigenvalues and eigenvectors. Probability. Integration techniques, solution of ordinary differential equations, sequences, series, applications of integration.

MATH1241
Higher Mathematics 1B
Staff Contact: School of Mathematics First Year Office
CP15 S2 HPW6
Prerequisite: MATH1131 or MATH1141, each with a mark of at least 70.
Note/s: Excluded MATH1021, MATH1032, MATH1042, MATH1231, ECON2200, ECON2201, ECON2202, ECON1201, ECON2290, ECON2291.

As for MATH1231 but in greater depth.

MATH2009
Engineering Mathematics 2
Staff Contact: School Office
CP20 F HPW4
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241

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.

MATH2011
Several Variable Calculus
Staff Contact: School Office
CP15 S1 HPW4
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2100, MATH2110, MATH2510, MATH2620.

Functions of several variables, limits and continuity, differentiability, gradients, surfaces, maxima and minima, Taylor series, Lagrange multipliers, chain rules, inverse function theorem, Jacobian derivatives, double and triple integrals, iterated integrals, Riemann sums, cylindrical and spherical coordinates, change of variables, centre of mass, curves in space, line integrals, parametrised surfaces, surface integrals, del, divergence and curl, Stokes' theorem, Green's theorem in the plane, applications to fluid dynamics and electrodynamics, orthogonal curvilinear coordinates, arc length and volume elements, gradient, divergence and curl in curvilinear coordinates.

MATH2019
ENGINEERING MATHEMATICS 2CE
CP15 F HPW3
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241
Notes: Excluded MATH2009.

Partial differentiation and applications, vector algebra, double integrals,ordinary differential equations, introduction to vector field theory, extrema of functions of 2 variables, matrices and their applications, Laplace transforms, Fourier series, partial differential equations and their solution for selected physical problems.

MATH2100
Vector Calculus
Staff Contact: School Office
CP7.5 S2 HPW2.5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2011, MATH2110.

Properties of vectors and vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss and Stokes' theorems. Curvilinear coordinates.

MATH2110
Higher Vector Analysis
Staff Contact: School Office
CP7.5 S1 HPW2.5
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, each with a mark of least 70.
Note/s: Excluded MATH2011, MATH2100.

As for MATH2100 but in greater depth.

MATH2120
Mathematical Methods for Differential Equations
Staff Contact: School Office
CP7.5 S1 or S2 HPW2.5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241.
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 coefficients, 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 equation, separation of variables methods, applications of Bessel functions and Legendre polynomials.

MATH2130
Higher Mathematical Methods for Differential Equations
Staff Contact: School Office
CP7.5 S2 HPW2.5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241, each with a mark of at least 70
Note/s: Excluded MATH2120.

As for MATH2120 but in greater depth.

MATH2501
Linear Algebra
Staff Contact: School Office
CP15 S1 or S2 HPW5 or F HPW2.5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241
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.

MATH2510
Real Analysis
Staff Contact: School Office
CP7.5 S1 HPW2.5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2011, MATH2610.

Multiple integrals, partial differentiation. Analysis of real valued functions of one and several variables.

MATH2520
Complex Analysis
Staff Contact: School Office
CP7.5 S1 or S2 HPW2.5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241
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
CP15 S1 HPW5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241, each with a mark of at least 70
Note/s: Excluded MATH2501.

As for MATH2501, but in greater depth, and with additional material on unitary, self-adjoint and normal transformations.

MATH2610
Higher Real Analysis
Staff Contact: School Office
CP7.5 S1 HPW2.5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241, each with a mark of at least 70
Note/s: Excluded MATH2011, MATH2510.

As for MATH2510 but in greater depth.

MATH2620
Higher Complex Analysis
Staff Contact: School Office
CP7.5 S1 or S2 HPW2.5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241, each with a mark of at least 70
Note/s: Excluded MATH2520.

As for MATH2520, but in greater depth.

MATH2801
Theory of Statistics
Staff Contact: School Office
CP15 S1 HPW4
Prerequisite: MATH1021(CR) or MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2819, MATH2821, MATH2921, MATH2841, MATH2901, BIOS2041.

Probability, random variables, standard distributions, bivariate distributions, transformations, central limit theorem, sampling distributions, point estimation, interval estimation, hypothesis testing.

MATH2810
Computing for Statistics
Staff Contact: School Office
CP7.5 S1 HPW2
Prerequisite: MATH1021(CR) or MATH1032 or MATH1231 or MATH1042 or MATH1241
Corequisite: MATH2801
Note/s: Excluded MATH2910.

Exploratory and graphical data analysis using various statistical packages; e.g. Minitab, Xlisp-stat, Splus. Visualisation of data. Dynamic graphics. Macro programming in statistical packages. Introduction to simulation of stochastic processes.

MATH2829
Statistics SU
Staff Contact: School Office
CP7.5 S1 HPW3
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241

Introduction to probability theory, random variables and distribution functions, sampling distributions, including those of chi-square, t and F. Estimation procedures, including confidence interval estimation with an emphasis on least squares and Geomatic Engineering problems, and computer based exercises.

MATH2831
Linear Models
Staff Contact: School Office
CP15 S2 HPW4
Prerequisites: MATH2801, MATH2810
Note/s: Excluded MATH2931, MATH3811, MATH3911, BIOS2041, MATH3870 (before 1997).

Multiple linear regression models and examples. Graphical methods for regression analysis. Multi-variate normal distribution. Quadratic forms (distributions and independence), Gauss-Markov theorem. Hypothesis testing. Model selection. Analysis of residuals. Influence diagnostics. Analysis of variance.

MATH2839
Statistics SM
Staff Contact: School Office
CP10 F HPW2
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2841, MATH2801, MATH2821, MATH2901, MATH2921.

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: chi-square, t and F. Estimation of parameters: the methods of moments and 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.

MATH2840
Sample Survey Theory
Staff Contact: School Office
CP7.5 S2 HPW2
Prerequisite: MATH2801
Note/s: Excluded MATH2940, MATH3820 (before 1997), MATH3920 (before 1997).

Finite population sampling theory. Simple random, systematic, stratified, cluster, and multi-stage sampling, sampling proportional to size. Estimation of means, totals, proportions and ratios. Estimation using auxiliary information. Post-stratification. Nonsampling errors including noncoverage and nonresponse.

MATH2841
Statistics SS
Staff Contact: School Office
CP15 F HPW2
Prerequisite: MATH1021(CR) or MATH1032 or MATH1231 or MATH1042 or MATH1241
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 chi-square, 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 EE
Staff Contact: School Office
CP9 S2 HPW3
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2841, MATH2801, MATH2901.

Probability and random variables with applications to multiple input-output systems. Markovian experiments. Random variables and their probability distributions. Multidimensional normal distributions. Linear filters driven by Gaussian noise. Linear regression and least squares methods. Inference for linear models. Applications from electrical engineering and computer science.

MATH2869
Applied Statistics SC
Staff Contact: School Office
CP5 S1 HPW2
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241
Notes: Excluded MATH2841, MATH2801, MATH2901.

Graphical data analysis, review of probability, random variables and their properties. The normal and binomial distributions, the central limit theorem, applications to quality control. Functions of random variables and their simulation using computers. One and two sample inference methods. Experimental designs for comparing two groups. Simple and multiple linear

regression. Relevant applications from fields of engineering will be

investigated in computer workshops.

MATH2901
Higher Theory of Statistics
Staff Contact: School Office
CP15 S1 HPW4
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2819, MATH2821, MATH2921, MATH2841, MATH2801, BIOS2041.

As for MATH2801 but in greater depth.

MATH2910
Higher Computing for Statistics
Staff Contact: School Office
CP7.5 S1 HPW2
Prerequisite: MATH1021(CR) or MATH1032 or MATH1231 or MATH1042 or MATH1241
Corequisite: MATH2901
Note/s: Excluded MATH2810.

As for MATH2810 but in greater depth.

MATH2931
Higher Linear Models
Staff Contact: School Office
CP15 S2 HPW4
Prerequisites: MATH2901, MATH2910
Note/s: Excluded MATH2831, MATH3811, MATH3911, BIOS2041, MATH3870 (before 1997).

As for MATH2831 but in greater depth

MATH2940
Higher Sample Survey Theory
Staff Contact: School Office
CP7.5 S2 HPW2
Prerequisite: MATH2901
Note/s: Excluded MATH2840, MATH3820 (before 1997), MATH3920 (before 1997).

As for MATH2840 but in greater depth.

MATH3141
Mathematical Methods EE
Staff Contact: School Office
CP15 S2 HPW4
Prerequisites: MATH2501 and one of MATH2100 or MATH2510 or MATH2011
Note/s: Excluded MATH2120, MATH2130, MATH3101.

Numerical methods: numerical errors, interpolation and approximation, numerical integration, ordinary differential equations, nonlinear equations, linear systems, matrix factorizations, orthogonalization, iterative methods for linear systems and eigenvalue problems, optimization.

Differential equations: linear differential equations, series solution of differential equations, Bessel functions, orthgonal polynomials, eigenvalue problems, generalised Fourier series, partial differential equations and boundary value problems.

MATH3150
Transform Methods
Staff Contact: School Office
CP7.5 S2 HPW2
Prerequisite: 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.

MATH3411
Information, Codes and Ciphers
Staff Contact: School Office
CP15 S2 HPW4
Note/s: Excluded MATH3420.

Discrete communication channels, information theory, compresssion and error control coding, cryptography.

MATS1002
Microstructural Analysis
Staff Contact: Dr P Krauklis
CP7.5 S1 L1 T2

Specimen preparation techniques. Principles of optical microscopy. Quantitative microscopy and stereology. Electron microscopy. Microchemical analysis.

MATS1042
Crystallography and X-Ray Diffraction
Staff Contact: Dr V Sahajwalla
CP10 S1 L2 T1

Introduction to crystallography, crystal structure, Bravais lattices, Miller indices. Miller-Bravais indices. Production, absorption and diffraction 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 chemical analysis.

MATS1072
Physics of Materials
Staff Contact: Dr B Gleeson
CP7.5 S1 L2 T1
Prerequisite: PHYS1002

Interatomic bonding in solid materials. Types of interatomic bonds, metallic, covalent, ionic. Introductory quantum mechanics in one dimension, free electron theory, effects of periodic potential, density of states curves. Effect of electron to atom ratio on conductivity and crystal structure; semiconductors; intrinsic, extrinsic. Exchange energy; ferromagnetism, anti-ferromagnetism. Elementary perturbation theory, covalent bond; crystal structures, properties. Ionic bond, force.

MATS1112
Phase Equilibria
Staff Contact: Dr B Gleeson
CP5 S2 L1 T1

Phase rule. Two-component systems: Free energy - composition and temperature composition diagrams, solubility limits, compound formation, invariants. Three-component systems: isothermal sections and liquid

projections. Solidification and crystallisation: cooling curves, crystallisation paths.

MATS1183
Non-Ferrous Physical Metallurgy
Staff Contact: Dr P Krauklis
CP5 S1 L1 T1

Constitution, microstructure, processing and properties of non-ferrous alloys. Cast and wrought alloys based on aluminium, copper, magnesium, lead, tin and zinc.

MATS1273
Ferrous Physical Metallurgy A
Staff Contact: Dr P Krauklis
CP10 S2 L2 T2

Binary and ternary iron-carbon equilibria. Carbon steel, phase transformation, microstructures, heat treatment and mechanical properties. Modification of carbon steel characteristics by alloying elements. Alloy engineering steels, tool and die steels, corrosion and oxidation resistant steels, high strength low-alloy steels. Microstructure and properties of grey, white, malleable, ductile and alloy cast irons.

MATS2213
Diffusion
Staff Contact: Prof DJ Young
CP5 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

MATS2223
Phase Transformations
Staff Contact: Dr B Gleeson
CP7.5 S2 L2 T1

Solidification: single phase, eutectic and neareutectic, peritectic. Diffusional transformation: percipitation, ripening, cooperative transformations, TTT and CCT curves. Diffusionless transformations: crystallography, nucleation and growth modes.

MATS4513
Deformation of Metals
Staff Contact: School Office
CP5 S1 L2

Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties.

MATS4523
Strengthening Mechanisms in Metals
Staff Contact: Dr B Gleeson
CP5 S2 L1 T1

Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallisation textures. Measurements of age-hardening, activation energy of strain ageing.

MATS4543
Fractographic Analysis
Staff Contact: Dr AG Crosky
CP7.5 S2 L1 T2

Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, 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.

MATS9520
Engineering Materials
Staff Contact: Dr AG Crosky
CP7.5 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 commercial 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: A/Prof CC Sorrell
CP7.5 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. Aspects 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.

PHPH2112
Physiology 1
Staff Contact: Dr JW Morley
CP30 F HPW6
Prerequisites: BIOS1101 and BIOS1201, CHEM1002 or CHEM1101 and CHEM1201, or a credit level pass in CHEM1302 or CHEM1401 and CHEM1501, MATH1032 or MATH1131 and MATH1231 or MATH1042 or MATH1141 and MATH1241 or MATH1021
Corequisites: BIOC2101 and BIOC2201 or BIOC2181 and **BIOC2291**
Note/s: Students intending to major in Physiology and/or Pharmacology should note level III Physiology prerequisites. Student numbers in Physiology 1 will be limited and entry to the course will be allocated on academic merit. Students who take BIOC2181 and BIOC2291 are advised that a grade of credit is normally required for progression to level III Physiology subjects. Students who do not obtain a credit in these subjects may be enrolled at the discretion of the Head of School. Introduces fundamental physiological principles, from basic cellular function in terms of chemical and physical principles, to the operation of the various specialised systems in the body, eg, 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 programs.

PHYS1002
Physics 1
Staff Contact: First Year Director
CP30 F HPW6
Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics (90-100), or 2 and 3 unit Mathematics (100-150), or 3 and 4 unit Mathematics (100-200) 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 (2 unit Mathematics in this instance refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics subject, and does not refer to the subjects Mathematics in Society or Mathematics in Practice).
Corequisite: MATH1021 or MATH1032 or MATH1131 and MATH1231.

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 polarisation.

Mid-year Start Students who fail Session 1 of PHYS1002 are strongly advised to discontinue the subject and enrol in Session 2 in PHYS1011 Physics I (FT1). This subject covers the Session 1 material of PHYS1002 during Session 2. Then PHYS1021 covers the rest of the syllabus over the Summer Session. Note: The Session 2 syllabus of PHYS1002 is not repeated in Session 1 of the next year.

PHYS1919
Physics 1 (Mechanical Engineering)
Staff Contact: First Year Director
Note/s: Not re-run in S2 and/or Summer Session

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, polarisation. Electrostatics, direct-current circuits. Elementary circuit theory. Magnetic forces and fields, electromagnetic induction. Introduction to electronics and electronic devices. Boolean algebra. Instrumentation.

PHYS1969
Physics 1 (Electrical Engineering)
Staff Contact: First Year Director

Electrostatics, magnetostatics in vacuum, ferromagnetism, electromagnetic induction. 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, interference, diffraction, grating and spectra, polarisation. Relativity, quantum physics, wave nature of matter.

Mid-Year Start Students who fail Session 1 of PHYS1969 are strongly advised to discontinue the subject and enrol in Session 2 in PHYS1949 Physics I (EE, FT1). This subject covers the Session 1 material of PHYS1969 during Session 2. Then PHYS1959 covers the rest of the syllabus over the Summer Session. Note: The Session 2 syllabus of PHYS1969 is not repeated in Session 1 of the next year.

PHYS1979
Physics 1 (Civil Engineering)
Staff Contact: First Year Director
Note/s: Not re-run in S2 and/or Summer Session.

Mechanics; elastic waves; electromagnetism; DC and AC circuits; introduction to electric measurement systems; instrumentation; digital electronic information processing systems; mechanical properties of matter; atomic structure; elasticity of solids; surface tension and viscosity of fluids; non-destructive testing; wave phenomena and acoustic techniques.

PHYS1998
Physics 1 (Geomatic Engineering)
Staff Contact: First Year Director

Vectors, linear mechanics. Newton's laws of motion, rotational mechanics. Electric forces, fields and potential, magnetic forces and fields. Ampere's Law, Faraday's Law, Electric circuit theory, Ac, Dc and transient circuits. Geometrical optics and instuments. Fluid mechanics; Bernoulli's equation, viscosity; Stoke's Law, Nuclear physics, radioactivity, half-life, nuclear forces, binding energies, fission and fusion.

PHYS2001
Mechanics, and Computational Physics
Staff Contact: Executive Assistant
CP15 S1 HPW4
Prerequisites: PHYS1002, MATH1032 or MATH1231.
Corequisite: MATH2011 or MATH2110
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
CP15 S2 HPW4
Prerequisites: PHYS1002, MATH1032 or MATH1231
Corequisites: MATH2011 or MATH2110
Note/s: Excluded PHYS2999.

Electric field strength and potential, Gauss' law, Poisson's and Laplace's equations, capacitance, dielectrics and polarisation, 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
CP15 F HPW2
Prerequisites: PHYS1002, MATH1032 or MATH1231
Note/s: Excluded PHYS2989, PHYS2949

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
CP15 F HPW3
Prerequisites: PHYS1002, MATH1032 or MATH1231
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.

PHYS2949
Physics 2 (Electrical Engineering)
Staff Contact: Executive Assistant

Electrostatics in vacuum and in dielectric materials. Electric current. Magnetostatic in vacuum and magnetic media, magnetic materials and magnetic circuits. Time-varying fields. Capacitance and inductance calculations. General field conceptsSuperconductivity. Maxwell's equation. Quantum mechanics; optical spectra and atomic structure, structural properties of solids, band theory and its applications, uniform electronic semiconductors in equilibrium, excess carriers in semiconductors.

PHYS2959
Introductory Semiconductor Physics (Computer Engineering)
Staff Contact: Executive Assistant

Semiconductor crystals and electrical conduction; elementry quantum theory; energy bands; band properties of semiconductor and applications, new developments, materials and techniques.

PHYS2969
Physics of Measurement (Geomatic Engineering)
Staff Contact: Executive Assistant

Resolution, accuracy and sensitivity of instruments. Errors of observation; transducers; mechanical design of apparatus; optical instruments, optical fibres; photometry; analogue-to-digital conversion and digital instruments. Measurements of very large and very small quantities.

PHYS2999
Mechanics and Thermal Physics (Electrical Engineering)
Staff Contact: Executive Assistant

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.

PHYS3010
Higher Quantum Mechanics
Staff Contact: Executive Assistant
CP7.5 S1 HPW2
Prerequisite: PHYS2021
Corequisite: MATH2120

Fundamental principles and matrix formulation, spherically symmetric systems, angular momentum theory, perturbation theory and semi classical radiation theory, variational methods, identical particles.

PHYS3021
Statistical Mechanics and Solid State Physics
Staff Contact: Executive Assistant
CP15 S1 HPW4
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
CP7.5 S1 HPW2
Prerequisites: PHYS2011, MATH2100, MATH2120
Excluded: PHYS3030
Note/s: Not available to Advanced Science students in programs 0100, 0121 and 0161

Electromagnetic fields; Maxwell's equations, Poynting theorem, electromagnetic potentials, Plane and spherical waves, Reflection and transmission, fields in dispersive media, models and applications, emission of radiation from accelerated charges, covariant formulation of electromagnetism.

PHYS3041
Experimental Physics A
Staff Contact: Executive Assistant
CP15 F HPW4
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.

PHYS3050
Nuclear Physics
Staff Contact: Executive Assistant
CP7.5 S2 HPW2
Prerequisite: PHYS3010 or PHYS3210 with a mark of 65 or greater

Nuclear shell model; theory of beta decay; the deuteron, nucleon-nucleon scattering; theories of nuclear reactions, resonances; mesons and strange particles, elementary particle properties and interactions; symmetries and quark models; strong and weak interactions.

PHYS3060
Advanced Optics
Staff Contact: Executive Assistant
CP7.5 S2 HPW2
Prerequisite: PHYS1002
Corequisite: MATH2120

Review of geometrical optics, including ray tracing, aberrations and optical instruments: physical optics, including Fresnel and Fraunhofer diffraction, transfer functions, coherence, and auto and cross correlation: applications of optics, including fibre optics, lasers and holography.

PHYS3110
Experimental Physics B1
Staff Contact: Executive Assistant
CP7.5 S1 HPW4
Prerequisite: PHYS2031

Selected experiments and projects. Advanced experimental techniques and open ended projects in the areas covered in PHYS3041 Experimental Physics A together with projects involving electron and nuclear magnetic resonances, low temperature physics and super-conductivity. Fourier optics, holography.

PHYS3120
Experimental Physics B2
Staff Contact: Executive Assistant
CP7.5 S2 HPW4
Prerequisite: PHYS2031

As for PHYS3110 Experimental Physics B1.

PHYS3210
Quantum Mechanics
Staff Contact: Executive Assistant
CP7.5 S1 HPW2
Prerequisite: PHYS2021
Corequisite: MATH2120
Excluded: PHYS3010
Note/s: Not available to Advanced Science students in programs 0100, 0121 and 0161

Principles of wave mechanics and its applications including harmonic oscillator, spherically symmetric systems, angular momentum, perturbation theory and semi classical radiation theory identical particles and the theory of atoms,solid state devices and quantum wells

POLY3010
Polymer Science
Staff Contact: A/Prof R Burford
CP15 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 polymerisation. 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.

SAFE9213
Introduction to Safety Engineering M
Staff Contact: Dr Tony Green
CP12
Assumed knowledge: SAFE9011 or PHYS1022

Note/s: This a modified version of SAFE9211 which is designed principally for engineers.

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: Mr Roger Hall
CP12
Assumed knowledge: Basic statistics and mechanics

The subject will give an introduction to ergonomics, emphasizing the principles of designing user-centred, human-machine-environment systems. Topics include: definition of and justification for ergonomics, design and human error, human capabilities and limitations, controls and displays, design of human-machine- environment systems, job design and work organisation, introduction to anthropometry, design of workplaces, introduction to manual handling and the physical environment, and, introduction to product design and human-computer interaction.

SAFE9544
Traffic Safety
Staff Contact: Dr Andrew McIntosh
CP12

This subject aims to provide students with an introduction to nature and scope of road safety and provide an understanding of the interdisciplinary and integrated approach required to implement improvements in roads and traffic safety. Subject areas include identification of road safety problems, strategic planning, road and road environment safety, ergonomics, signals, signs, lighting, road user safety, knowledge, attitudes, compliance and practices, vehicle and equipment safety, road safety school education, road safety campaigns and program evaluation.

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 *Table of 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 Juridical Science	SJD	Law
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 Art Administration	MArtAdmin	College of Fine Arts
Master of Art Education	MArtEd	College of Fine Arts
Master of Art Education(Honours)	MArtEd(Hons)	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	Abbreviation	Calendar/Handbook
Master of Business Administration (Executive)	MBA(Exec)	AGSM
Master of Business and Technology	MBT	Engineering
Master of Chemistry	MChem	Science*
Master of Clinical Education	MClinEd	Medicine
Master of Commerce (Honours)	MCom(Hons)	Commerce and Economics
Master of Commerce	MCom	Commerce and Economics
Master of Community Health	MCH	Medicine
Master of Community Paediatrics	MCommPaed	Medicine
Master of Computational Science	MComputationalSc	Science
Master of Computer Science	MCompSc	Engineering
Master of Construction Management	MConstMgt	Built Environment
Master of Couple and Family Therapy	MCFT	Professional Studies
Master of Defence Studies	MDefStud	University College
Master of Design(Honours)	MDes(Hons)	College of Fine Arts
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	MEdAdmin	Professional Studies
Master of Engineering	ME	Applied Science Engineering University College
Master of Engineering *without supervision*	ME	Applied Science Engineering
Master of Engineering Science	MEngSc	Engineering Applied Science University College
Master of Environmental Engineering Science	MEnvEngSc	Engineering
Master of Environmental Studies	MEnvStudies	Applied Science
Master of Equity and Social Administration	MEqSocAdmin	Professional Studies
Master of Fine Arts	MFA	College of Fine Arts
Master of Health Administration	MHA	Professional Studies
Master of Health Personnel Education	MHPEd	Medicine
Master of Health Planning	MHP	Professional Studies
Master of Higher Education	MHEd	Professional Studies
Master of Industrial Design	MID	Built Environment
Master of Information Management	MIM	Professional Studies
Master of Information Science	MInfSc	Engineering
Master of International Social Development	MIntSocDev	Professional Studies
Master of Medicine	MMed	Medicine
Master of Landscape Architecture	MLArch	Built Environment
Master of Landscape Planning	MLP	Built Environment
Master of Law and Management	MLM	AGSM Law
Master of Laws	LLM	Law
Master of Librarianship	MLib	Professional Studies
Master of Management Economics	MMgtEc	University College
Master of Mathematics	MMath	Science*
Master of Medicine	MMed	Medicine
Master of Mining Management	MMinMgmt	Applied Science
Master of Music	MMus	Arts and Social Sciences
Master of Music (Honours)	MMus(Hons)	Arts and Social Sciences
Master of Music Education (Honours)	MMusEd(Hons)	Arts and Social Sciences
Master of Optometry	MOptom	Science*
Master of Policy Studies	MPS	Arts and Social Sciences
Master of Project Management	MProjMgt	Built Environment

Title	Abbreviation	Calendar/Handbook
Master of Public Health	MPH	Medicine Professional Studies
Master of Psychological Medicine	MPM	Medicine
Master of Psychology (Applied)	MPsychol	Science†
Master of Psychology (Clinical)	MPsychol	Science†
Master of Real Estate	MRE	Built Environment
Master of Real Property	MRProp	Built Environment
Master of Safety Science	MSafetySc	Applied Science
Master of Science	MSc	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)	MSc(IndDes)	Built Environment
Master of Social Work	MSW	Professional Studies
Master of Sports Science	MSpSc	Professional Studies
Master of Sports Medicine	MSpMed	Medicine
Master of Statistics	MStats	Science*
Master of Surgery	MS	Medicine
Master of Taxation	MTax	ATAX
Master of Technology Management	MTM	Applied Science Commerce and Economics Engineering
Master of Town Planning	MTP	Built Environment
Master of Urban Development and Design	MUDD	Built Environment

Graduate Diplomas

Graduate Diploma	GradDip	AGSM Applied Science Architecture Arts and Social Sciences Commerce and Economics Engineering Medicine Professional Studies Science*†
Advanced Taxation	GradDipAdvTax	Board of Studies in Taxation
Arts	GradDipArts	Arts and Social Sciences
Couple and Family Therapy	GradDipC/F Therapy	Professional Studies
Clinical Education	GradDipClinEd	Medicine
Community Paediatrics	GradDipCommPaed	Medicine
Education	DipEd	Professional Studies
Equity and Social Administration	GradDipEq&SocAdmin	Professional Studies
Food and Drug Analysis	DipFDA	Science*
Higher Education	GradDipHEd	Professional Studies
Higher Personnel Education	GradDipHPEd	Medicine
Information Management - Archives/Records	GradDipIM-Archiv/Rec	Professional Studies
Librarianship	GradDipIM-Lib	Professional Studies
Industrial Management	GradDipIndMgt	Engineering
International Social Development	GradDipIntSocDev	Professional Studies
Music	GradDipMus	Arts and Social Sciences
Paediatrics	GradDipPaed	Medicine
Pharmaceutical Sciences	GradDipPharmSc	Medicine
Sports Medicine	GradDipSpMed	Medicine

Title	Abbreviation	Calendar/Handbook
Taxation Studies	GradDipTaxStud	Board of Studies in Taxation

Graduate Certificates

Arts	GradCertArts	Arts and Social Sciences
Commerce	GradCertCom	Commerce and Economics
Health Administration	GradCertHealthAdmin	Professional Studies
Higher Education	GradCertHEd	Professional Studies
Music	GradCertMus	Arts and Social Sciences
Pharmaceutical Sciences	GradCertPharmSc	Medicine

**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 organisation or institution will have a co-supervisor at that institution.

Progression

4. The progress of the candidate shall be considered by the Committee following report from the School in accordance with the procedures established within the School and previously noted by the Committee.

(i) The research proposal will be reviewed as soon as feasible after enrolment. For a full-time student this will normally be during the first year of study, or immediately following a period of prescribed coursework. This review will focus on the viability of the research proposal.

(ii) Progress in the course will be reviewed within twelve months of the first review. As a result of either review the Committee may cancel enrolment or take such other action as it considers appropriate. Thereafter, the progress of the candidate will be reviewed annually.

Thesis

5. (1) On completing the program of study a candidate shall submit a thesis embodying the results of the investigation.

(2)The candidate shall give in writing to the Registrar two months notice of intention to submit the thesis.

(3)The thesis shall comply with the following requirements:

(a)it must be an original and significant contribution to knowledge of the subject;

(b) the greater proportion of the work described must have been completed subsequent to enrolment for the degree;

(c) it must be written in English except that a candidate in the Faculty of Arts 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 in the further work recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to submit the thesis for re-examination as determined by the Committee within a period determined by it but not exceeding eighteen months.

(4) After consideration of the examiners' reports and the results of any further examination of the thesis, the Committee may require the candidate to submit to written or oral examination before recommending whether or not the candidate 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.

**'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.*

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)

1. The degree of Master of Biomedical Engineering may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

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 240 credit points. The number of credit points 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

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 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 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) Alternatively 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. A candidate may then be granted advanced standing in the Master of Business and Technology for the subjects already completed in the Graduate Diploma in Industrial Management up to a limit of 18 credits with the provision that the candidate has not already graduated.

(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 in the case of a part-time candidate or two academic sessions in the case of a full-time candidate. The maximum period of candidature shall be ten academic sessions from the date of enrolment for a part-time candidate and five academic sessions for a full-time candidate. 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 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 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 240 credit points. 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

90 Credit Point Project Report

4. (1) A candidate who undertakes a 90 credit point 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 90 Credit Point 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 is unsatisfactory the Committee shall determine whether or not the candidate may resubmit it after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of 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 teaching 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; or

(c) the candidate be awarded the degree subject to further examination on questions posed in the report, performance in this further examination being to the satisfaction of the Committee; or

(d) the candidate be not awarded the degree but be permitted to resubmit the thesis in a revised form after a further period of study and/or research; or

(e) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

(3) If the performance at the further examination recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to re-present the same thesis and submit to a further oral, practical or written examination within a period specified by it but not exceeding eighteen months.

(4) The Committee shall, after consideration of the examiners' reports and the reports of any oral or written or practical examination, recommend whether or not the candidate may be awarded the degree. if it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

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) and Master of Science (MSc) *without supervision*

1. The degree of Master of Engineering or Master of Science 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 in 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)

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 120 credit points. The number of credit points 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.

**'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 teaching unit.*

(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

36, 45 or 48 Credit Point Project Report

4. (1) A candidate who undertakes an 36, 45 or 48 credit point 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.

(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 36, 45 or 48 Credit Point 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)

1. The degree of Master of Information Science may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

Qualifications

2. (1) A candidate for the degree shall have ben awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty of Engineering (hereinafter referred to as the Committee).

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar two calendar months before the commencement of the session in which the enrolment is to begin.

(2) A candidate for the degree shall:

(a) undertake such formal subjects and pass such assessment as prescribed, or

(b) undertake an approved combination of the above and demonstrate ability to undertake research by the submission of a project report embodying the results of an original investigation of an approved topic.

(3) The program of advanced study shall total a minimum of 180 credit points. The number of credit points 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

90 Credit Point Project Report

4. (1) A candidate who undertakes an 90 credit point 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 90 Credit Point 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.

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.

†*Failure of 24 credit points may result in exclusion from the graduate diploma.*

**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) Alternatively 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 may 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.

(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 for a part-time candidate. The maximum period of candidature shall be six sessions from the date of enrolment for a part-time candidate or three sessions for a full-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 recommended from time to time by the Graduate School of Engineering.

Scholarships

The scholarships listed below are available to students whose courses are listed in this book. Each faculty handbook contains in its scholarships section the scholarships available for study in that faculty. Travel scholarships are shown separately. Applicants should note that the scholarships and their conditions are subject to review and the closing dates for awards may vary from year to year.

Scholarship information is regularly included in the University publication 'Uniken/Focus'.

Students investigating study opportunities overseas should also consult Study Abroad which is published by UNESCO and is available in the University library. The British Council (02 9326 2365) may be of assistance for information about study in Britain. The Australian-American Education Foundation (06 247 9331) can provide information about study in America. Information may also be obtained from the embassy or consulate of the country in which the study is proposed and from the proposed overseas institution. Details of overseas awards and exchanges administered by the Department of Employment, Education, Training and Youth Affairs (DEETYA) can be obtained from the Awards and Exchanges Section, DEETYA, PO Box 826, Woden, ACT 2606.

KEY

L Students with Australian Citizenship or Permanent Resident status can apply.

I International students can apply.

Postgraduate scholarships for research or coursework are identified with the following codes:

R Available for study by research (normally Masters by Research or PhD).

C Available for study by coursework (normally Masters by Coursework or Graduate Diploma).

The scholarship information is normally provided in the following format:

- Amount
- Duration
- Conditions

Unless otherwise stated, application forms are available from the Scholarships Unit, c\- the Student Centre (Lower Ground Floor, Chancellery). Applications normally become available four to six weeks before the closing date.

Undergraduate Scholarships

Following are details of scholarships available to undergraduate students at UNSW.

The scholarships are listed according to the year of study for which the scholarship is available (ie scholarships for first year students; scholarships for second or later year students; scholarships for Honours year students) or whether they are available to undertake travel, and then also by Faculty and course (eg scholarships in Science or Engineering). If a scholarship is available to all students it will be listed in the General Scholarships section.

For further information contact:

The Scholarships Unit
The University of New South Wales
Sydney 2052 Australia
Tel (02) 9385 3100/3101/1462
Fax (02) 9662 1049
Email: R.Plain@unsw.edu.au

Scholarships for students entering the first year of an undergraduate course

General

The Alumni Association Scholarships (I,L)

- Up to $1,500 pa
- 1 year with the possibility of renewal

The scholarships are available to students enrolled in any year of a full-time undergraduate course. Candidates must be the children or grandchildren of alumni of the University of New South Wales. Applications close mid-January.

The Australian Development Co-operation Scholarship (ADCOS) (I)

- Tuition fees. Some students may be eligible for airfares and a stipend.
- Determined by normal course duration

This award is for international students from selected countries only. Information and application forms should be obtained from the Australian Education Centre or Diplomatic Post in the home country. The award conditions and entitlements vary depending on the home country. The closing date is normally early in the year before the year of study.

The Australian Vietnam Veterans Trust Education Assistance Scheme (L)

- $3,500 pa for the duration of the course

Applicants must be a child of a Vietnam veteran and under the age of 25 at the time of application. The award is subject to the same income test as AUSTUDY. Applicants can be undertaking any year of a Bachelors course. Applications and further information are available from the Australian Vietnam War Veterans Trust National Office, PO Box K978, Haymarket NSW 2000 (02 9281 7077). Applications close 31 October.

The Ben Lexcen Sports Scholarships (I,L)

- $2,000 pa
- 1 year with possibility of renewal

The scholarships are 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 the Manager, Sports Association, UNSW, Sydney 2052 Australia. Tel (02) 9385 6022, Fax (02) 9385 6180.

The UNSW Co-Op Program (L)

- $10,400 pa and between 9 and 20 months industry training
- The duration of the course subject to satisfactory progress

The scholarships are offered by industry groups through the University in the three faculties of Applied Science, Commerce and Economics and Engineering. Scholars are selected by interview with emphasis placed on achievements in community and extra-curricular activities as well as communication and leadership skills.

A minimum TER of around 90 is expected. The Co-Op Application Form is available from school Careers Advisers or the Co-op Office on (02) 9385 5116. Applications close September 30 with interviews held at the end of November and beginning of December.

The Girls Realm Guild Scholarships (L)

- Up to $1,500 pa
- 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need

The scholarships are available to female students under 35 years of age who are enrolling in any year of a full-time undergraduate course. Selection is based on academic merit and financial need. Applications close 25 March.

The John Niland Scholarships (L)

- $5,000
- 1 year

The scholarship provides assistance to enhance the opportunity of students from country high schools in Australia to enrol in an undergraduate program of study at UNSW. Applicants will be students who complete the HSC (or its counterpart matriculation requirement) in the top five percent of their state-wide cohort, having been enrolled at a country high school in Australia. Selection will be based on academic merit, potential to contribute to the wider life of the University and consideration of social and/or economic circumstances which might otherwise hinder successful transition to UNSW. Applications close 30 October.

The National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships (L)

- $22,250
- Up to 3 years

Applicants may be undertaking an undergraduate degree in order to pursue research relevant to Aboriginal health. Applications close mid-July.

The Ngunnagan Club Scholarship (L)

- Up to $2,000
- 1 year

The scholarship is available to students enrolled at an Australian country high school who complete the HSC (or its counterpart matriculation requirement) in the top five per cent of their state cohort. Applicants should complete an official application form by 31 October in the year prior to their intended enrolment at UNSW. Final performance in the HSC (or its counterpart matriculation) examination should be reported to the Scholarships Unit once known.

The W.S. and L.B. Robinson Scholarship (L)

- Up to $6,500 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must have completed their schooling in Broken Hill or have parents who reside in Broken Hill. Applicants should be undertaking a course related to the mining industry, for example courses in Mining Engineering, Geology, Electrical and Mechanical Engineering, Metallurgical Process Engineering, Chemical Engineering or Science. A letter of application should be sent to Pasminco Mining, PO Box 460, Broken Hill, NSW 2880. Applications close 30 September each year.

Faculty

Engineering

Female students planning to undertake Year 1 of a Bachelor of Engineering in any school of the Faculty of Engineering may be eligible to apply for the Alexandria Ada Lam Scholarship. Female students planning to undertake Year 1 of Bachelor of Engineering in Electrical or Mechanical Engineering may be eligible to apply for the Vida Balshaw Women in Engineering Scholarship.

The Alexandria Ada Lam Scholarship (L)

- $1,000
- The duration of the course, subject to satisfactory performance

One scholarship is available to a female student who undertook the HSC in the previous year and is enrolling in the first year of a Bachelor of Engineering degree course in the Faculty of Engineering. Applicants will be initially assessed on the basis of academic merit. Consideration will also be given to the reasons for undertaking the course and financial need. Applications close at the end of January.

The Jack Beale Scholarship (I,L)

- Up to $1,000
- 1 year

The scholarship is available to first year students enrolling in the Faculty of Engineering who are concerned about water resources and the environment. Applications close 31 October.

The Vida Balshaw Women in Engineering Scholarship (L)

- The value has not yet been determined
- 1 year

One scholarship is available to a female student enrolling in the first year of a Bachelor of Engineering degree course in Electrical or Mechanical Engineering. Applicants will be considered on the basis of academic merit and financial need. Applications close at the end of January.

Civil Engineering

The Jacob N Frenkel Scholarship in Civil Engineering (L)

- Up to $1,200
- 1 year

The scholarship is to provide assistance to secondary school students to study Civil Engineering at UNSW.

Selection is based on academic merit, reason for study and financial need. Applications close 31 October.

Geomatic Engineering

The Institution of Surveyors Scholarship (L)

- Up to $1,000 pa
- 1 year renewable for the duration of the course, subject to satisfactory progress

Applicants must be eligible for admission to the full-time degree course in Geomatic Engineering. Selection is based on academic merit, personal qualities and financial need. Applications close at the end of January each year.

The Surveyor-Generals Scholarship for Women in Surveying (L)

- Up to $2,000 pa
- 1 year

The scholarship is available to female students entering Year 1 of the full-time degree course in the Geomatic Engineering course. Applications close at the end of January.

Scholarships for students in their second or later years of study

General

The Alumni Association Scholarships (I,L)

- Up to $1,500 pa
- 1 year with the possibility of renewal

The scholarships are available to students enrolled in any year of a full-time undergraduate course. Candidates must be the children or grandchildren of alumni of the University of New South Wales. Applications close early January.

The Australian Vietnam Veterans Trust Education Assistance Scheme (L)

- $3,500 pa for the duration of the course.

Applicants must be a child of a Vietnam veteran and under the age of 25 at the time of application. The award is subject to the same income test as AUSTUDY. Applicants can be undertaking any year of a Bachelors course. Applications and further information are available from the Australian Vietnam War Veterans Trust National Office, PO Box K978, Haymarket NSW 2000 (tel 02 9281 7077). Applications close 31 October.

The Ben Lexcen Sports Scholarships (I,L)

- $2,000 pa
- 1 year with possibility of renewal

The scholarships are 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 the Manager, Sports Association, UNSW, Sydney 2052. Tel (02) 9385 6022, Fax (02) 9385 6180.

The Girls Realm Guild Scholarship (L)

- Up to $1,500 pa
- 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need

The scholarships are available only to female students under 35 years of age who are enrolling in any year of a full-time undergraduate course. Selection is based on academic merit and financial need. Applications close 25 March.

The Minproc Engineering Limited Scholarship (L)

- $6500 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

The scholarship is available to a student entering either Year 3 or 4 of the Bachelor of Engineering Science course with subject content in the fields of Engineering or Mineral Chemistry, or a Bachelor of Engineering with majors in the fields of Chemical, Metallurgical or Mechanical Engineering, or related courses. Applications close early March.

The National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships (L)

- $22,250
- Up to 3 years

Applicants may be undertaking an undergraduate degree in order to pursue research relevant to Aboriginal health. Applications close mid July.

The NSW Ministry for the Arts Scholarships (L, R, C)

- $5,000 - $25,000 (depending on the award)

The NSW Government offers a number of scholarships and awards to writers, artists and scholars living in NSW. Further information is available from New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000. Tel (02) 9228 3533, Fax (02) 9228 4722.

The Pig Research and Development Corporation (PRDC) Undergraduate Encouragement Award (L)

- $600 lump sum

Applicants must be in the later stage of an undergraduate degree and interested in undertaking a research project related to the Australian pig industry. Applications close 3 times a year (ie 1 March, 1 July, 1 October).

The Sam Cracknell Memorial Scholarships (I,L)

- Up to $1,500 pa
- 1 year

Applicants should have already completed at least 2 years of a degree or diploma course and be enrolled in a full-time course during the year of application. Selection is based on academic merit, participation in sport both directly and administratively and financial need. Applications close 31 March.

The Telstra Education Fellowships (L)

- $7,500
- 1 year

Applicants must be in the final year of study in the disciplines of computer, electrical or electronic engineering or computer science. Applications normally close at the end of July.

The W.S. and L.B. Robinson Scholarship (L)

- Up to $6,500 pa·1 year renewable for the duration of the course subject to satisfactory progress

Applicants must have completed their schooling in Broken Hill or have parents who reside in Broken Hill. Applicants should be undertaking a course related to the mining industry, for example courses in Mining Engineering, Geology, Electrical and Mechanical Engineering, Metallurgical Process Engineering, Chemical Engineering and Science. A letter of application should be sent to Pasminco Mining, PO Box 460, Broken Hill, NSW 2880. Applications close 30 September.

Engineering

ACMEE Scholarship in Engineering (I,L)

- Up to $1,200
- 1 year

Applicants must be in their final year of study in any discipline of a Bachelor of Engineering degree in the Faculty of Engineering. The scholarship is to advance the management education of engineers. Selection is based on academic achievement particularly in the field of management, demonstrated participation and performance in industry, and an intended final year project related to management and business performance in an engineering-based enterprise. Applications will be sought early in first session and the successful applicant announced mid-way through the session.

The Connell Wagner Scholarship (L)

- $1,500
- 1 year only

The scholarship is available to students enrolled in Year 3 of the degree course in Environmental Engineering. Applications normally close in March.

Honours Year Scholarships

General

The Alumni Association Scholarships (I,L)

- Up to $1,500 pa
- 1 year with the possibility of renewal

The scholarships are available to students enrolled in any year of a full-time undergraduate course. Candidates must be the children or grandchildren of alumni of the university of new south wales. Applications close 13 January.

The Apex Foundation for Research into Intellectual Disability Studentships (I,L)

- $1,000 paid in a lump sum

The studentships are available to students preparing a thesis related to intellectual disability. Applications should be in the form of a letter which includes a curriculum-vitae and thesis plan and must be supported by a letter from the head of school/department. Applications should be sent to the honorary secretary, apex foundation studentships, PO Box 311, Mt Evelyn Vic 3796 by 31 May.

The Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART) Student Award (I,L)

- $1,000 for attendance at the annual conference

Applicants can be Honours students from any discipline. The award provides assistance for a student to attend the annual conference. Applications are available from ANZCCART, PO Box 19 Glen Osmond, SA, 5064, (tel 08 303 7325). Applications close in July.

The Australian Vietnam Veterans Trust Education Assistance Scheme (L)

- $3,500 pa for the duration of the course

Applicants must be a child of a Vietnam veteran and under the age of 25 at the time of application. The award is subject to the same income test as AUSTUDY. Applicants can be undertaking any year of a Bachelors course. Applications and further information are available from the Australian Vietnam War Veterans Trust National Office, PO Box K978, Haymarket NSW 2000 (tel 02 9281 7077). Applications close 31 October.

The Ben Lexcen Sports Scholarships (I,L)

- $2,000 pa
- 1 year with possibility of renewal

The scholarships are 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 the Manager, Sports Association, UNSW, Sydney 2052. Tel (02) 9385 6022, Fax (02) 9385 6180.

The Girls Realm Guild Scholarships (L)

- Up to $1,500 pa
- 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need

The scholarships are available only to female students under 35 years of age who are enrolling in any year of a full-time undergraduate course. Selection is based on academic merit and financial need. Applications close 25 March.

The Grains Research and Development Corporation (GRDC) Undergraduate Honours Scholarship (I,L)

- $6,000 (ie $5,000 to the student and $1,000 to the host School/Department).
- 1 year

Applicants must be undertaking a full-time Honours program. Study in an area of significance to the grains industry will be viewed favourably. A letter of application, including a curriculum-vitae, academic record, letter of support from the Head of School/Department and 2 referees' supporting statements, should be sent to GRDC Undergraduate Honours Scholarship, PO Box E6, Queen Victoria Terrace, Canberra ACT 2600 (06 2725528). Applications close late November.

The Great Barrier Reef Marine Park Authority Research Support (I,L)

- $1,500

Applicants must be undertaking a full-time Honours year or PhD research project that could contribute to the planning and managing work undertaken by the Great Barrier Reef Marine Park Authority. Applications and further information may be obtained from the Executive Officer, Great Barrier Reef Marine Park Authority, PO Box 1379, Townsville QLD 4810 (tel 077 818811). Applications close mid-December.

The Mitsui Education Foundation Scholarship (L)

A one month scholarship to Japan is available to a young Australian national to help promote goodwill between the two countries. Candidates should be full-time undergraduate students aged between 20-24 and preferably in their third or fourth year. The successful student will travel to Japan during November and December. Application forms become available in June and close mid-July.

The National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships (L)

- $22,250
- Up to 3 years

Applicants may be undertaking an undergraduate degree in order to pursue research relevant to Aboriginal health. Applications close mid-July.

The NSW Ministry for the Arts Scholarships (L, R, C)

- $5,000 - $25,000 (depending on the award)

The NSW Government offers a number of scholarships and awards to writers, artists and scholars living in NSW. Further information is available from New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000. Tel (02) 9228 3533, Fax (02) 9228 4722.

The Pig Research and Development Corporation (PRDC) Undergraduate Encouragement Award (L)

- $600 lump sum.

Applicants must be in the later stage of an undergraduate degree and interested in undertaking a research project related to the Australian pig industry. Applications close 3 times a year (ie 1 March, 1 July, 1 October).

The River Basin Management Society Ernest Jackson Memorial Research Grants (I,L)

- Up to $2,000

The scholarship is available to assist students undertaking research in the field of River Basin Management. Applications close on 11 August.

The RSPCA Alan White Scholarship (I,L)

- $2,500

Applicants should be undertaking original research to improve the understanding and welfare of animals. A letter of application should be sent to the Executive Officer,

RSPCA Australia, PO Box E369, Queen Victoria Terrace, Canberra ACT 2600 (tel 06 2311437) by 31 March.

The Sam Cracknell Memorial Scholarship (I,L)

- Up to $1,500 pa
- 1 year

Applicants should have already completed at least 2 years of a degree or diploma course and be enrolled in a full-time course during the year of application. Selection is based on academic merit, participation in sport both directly and administratively and financial need.
Applications close 31 March.

The University Honours Year Scholarships (I,L)

- $1,000
- 1 year

A number of scholarships will be awarded on the basis of academic merit for students entering an 'add-on' honours year, ie the honours year in a degree course which is normally a pass degree but which has the option of a further year of study at Honours level. Applications close 30 November.

The W.S. and L.B. Robinson Scholarship (L)

- Up to $6,500 pa. 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must have completed their schooling in Broken Hill or have parents who reside in Broken Hill. Applicants should be undertaking a course related to the mining industry, for example courses in Mining Engineering, Geology, Electrical and Mechanical Engineering, Metallurgical Process Engineering, Chemical Engineering and Science. A letter of application should be sent to Pasminco Mining, PO Box 460, Broken Hill, NSW 2880. Applications close 30 September.

Travel Scholarships

General

The Arthur Anderson Study Abroad Scholarship (L)

- Up to $2,500

The scholarship is to provide financial assistance to students in their second or third year of full-time study who wish to study abroad for one semester at an approved Asian university. The overseas study must count towards their UNSW degree. Students must satisfy the language and literacy requirements of the approved university. Candidates will be required to complete an application form at least four months prior to the commencement of the scholarship. Further information is available from the International Student Centre. Tel (02) 9385 5333.

The Association of International Education Japan (AIEJ) Short-Term Student Exchange Promotion Program (Inbound) Peace and Friendship Scholarships (I,L)

- 50,000 yen (settling-in allowance), 100,000 yen per month, plus airfare
- Ten months to one year

Applicants must be accepted by a Japanese university under a student exchange program agreement with UNSW. Students must initially apply directly to a Japanese university through the International Student Centre at UNSW. The Japanese host university will recommend candidates to AIEJ and students must apply as directed by the host university. Applications close in February, May and September each year.

The Association of International Education Japan (AIEJ) Short-Term Student Exchange Promotion Program (Inbound) Scholarships (I,L)

- 50,000 yen (settling-in allowance), 80,000 yen per month, plus airfare
- Six months to one year

Applicants must be accepted by a Japanese university under a student exchange program agreement with UNSW. Students must initially apply directly to a Japanese university through the International Student Centre at UNSW. The Japanese host university will recommend candidates to AIEJ and students must apply as directed by the host university. Applications close in February, May and September each year.

DAAD - The German Academic Exchange Service Scholarships (L)

Application forms for the following scholarships are available from the Consulate General of the Federal Republic of Germany, PO Box 204, Woollahra NSW 2025.

One-Semester German Studies Scholarships

- DM1,000 a month living allowance, travel assistance of DM2,500 and the health insurance contribution
- One semester

Applicants must be in their third year of German Studies. Applications close 1 July.

Deutschlandkundlicher Winterkurs

- DM3,500 to assist with travel and living expenses and course fees

Undergraduate and postgraduate students from all fields with at least two years University level German (with a better than B average) may apply for this scholarship. The students should be aged from 19 to 32 and proposing to undertake the 8 week (in January and February 1997) German studies course (in German) at the University of Freiburg. The course provides language instruction and concentrates on historical and cultural aspects of contemporary Germany for students with some knowledge of German and a background in German Studies. Applications close 1 August.

The International Exchange Travel Scholarships (L)

- Up to $1,500 pa
- 1 year

The scholarships were established to encourage UNSW students to participate in the University's formal international exchange programs. Students must be undergraduates embarking on a period of study overseas which will count toward their UNSW degree. Awards will be granted on the basis of academic merit. Interested students should contact the International Student Centre, tel (02) 9385 5333.

The Mitsui Education Foundation Scholarship (L)

A one month scholarship to Japan is available to a young Australian national to help promote goodwill between the two countries. Candidates should be full-time undergraduate students aged between 20-24 and preferably in their third or fourth year. The successful student will travel to Japan during November and December. Application forms become available in June and close mid-July.

The National Asian Languages Scholarship (L)

Students who have completed two years of tertiary level language study can apply to undertake advanced language study in Asia for 6 to 12 months. Applications close 15 September.

The NSW Travelling Art Scholarship (L)

- $25,000

The scholarship is available to an emerging visual artist to undertake a course of study or training overseas for one or two years. Guidelines and applications are available from NSW Ministry for the Arts, GPO Box 5341, Sydney 2001 (02 228 5533). Applications normally close in July.

The Robert Sutton/ Jardine Matheson Scholarship (L)

- Up to $1,000

This scholarship is available to provide an Honours year student, from either the Faculty of Commerce or from the Faculty of Arts, with assistance to undertake a semester of study in Asia which would count towards their degree. Further information is available from the International Student Centre.

The Swiss Confederation Scholarships (L)

One scholarship may be available from The Swiss Confederation for art studies (for example, painting, graphic design, sculpture, music) in the 1997/1998 academic year. The scholarship will be awarded on the basis of academic merit and the possibilities for study in Switzerland. Applicants must have been born after 1 January 1962. The scholarship can only be allocated after the candidate has been accepted by a Swiss art school or conservatory. Applicants will be required to pass a language test in German or French. Applications close 1 December 1996.

The STA Travel Grant (I,L)

- Up to $3,000

Applicants must be undertaking study leading to a degree or diploma of the University and be members of the University Union. The grant is awarded on the basis of significant contribution to the community life of the University involving a leadership role in student affairs and the University Union and the relevance and merit of the proposed travel to the student's academic program or University Union activities. Applications close 30 April each year.

Faculty

Engineering

The NSK Silver Jubilee Scholarship for Study in Japan (L)

- Up to $2,500 for return airfares to Japan
- From 1-3 months

Applicants must be undertaking Year 3 or Year 4 (equivalent) of a degree course in the School of Mechanical and Manufacturing Engineering. The scholarship is awarded on the basis of academic merit, a demonstrated interest in Japan and the submission of a satisfactory itinerary of intended industrial visits in Japan. Applications close in October each year.

Graduate Scholarships

Following are details of scholarships available to postgraduate students at UNSW.

The scholarships are listed by Faculty and course (eg scholarships in Science or Engineering) or whether they are available to undertake travel. If a scholarship is available to all students it will be listed in the General Scholarships section.

For further information contact:

The Scholarships Unit
The University of New South Wales
Sydney 2052 Australia

Tel (02) 9385 3100/3101/1462
Fax (02) 9662 1049
E-mail: R.Plain@unsw.edu.au

General Scholarships

Main programs of assistance for postgraduate study

The Australian Postgraduate Awards (APA) (L, R)

- $15,364 pa (1996 rate). Other allowances may also be paid.
- Up to 2 years for a Masters, 3 years for a PhD degree. PhD students may apply for up to 6 months extension in certain circumstances.

Applicants must have graduated, or be proposing to graduate in the current academic year, with Honours 1 or equivalent. The scholarships are available to undertake a Masters by Research or PhD. Students with Permanent Resident status must have lived in Australia continuously for 12 months. Applications close in late October.

The Australian Development Co-operation Scholarship (ADCOS) (I, R, C)

- Tuition fees. Some students may be eligible for air fares and a stipend.
- Determined by normal course duration

This award is for international students from selected countries only. Information should be obtained from Australian Diplomatic Posts or Australian Education Centres in the home country. Conditions and entitlements vary depending on the home country.

The Overseas Postgraduate Research Scholarships (OPRS) (I, R)

- Tuition fees and medical cover only
- 2 years for a Masters, 3 years for a PhD

Eligibility is confined to postgraduate research students who are citizens of countries other than Australia or New Zealand. Applications close in late September.

Other General Scholarships

The Arthritis Foundation Research Scholarships (L, R)

- $8,000 - $22,000 pa
- 1 year with a possible 2 year extension

Applicants must be enrolled in studies leading to a PhD or MD. Awards are offered for clinical, scientific and allied health professional research and professional education projects. Specific awards relate to studies of rheumatoid arthritis, osteoporosis, ankylosing spondylitis, lupus, scleroderma, fibromyalgia and Paget's Disease. Applications close with the Foundation in early June.

The Australian Brewers Foundation Alcohol Related Medical Research Postgraduate Scholarships (I, L, R)

- Similar to the NH&MRC (see NH&MRC entry)
- 1 year

Similar to the NH&MRC. The scholarships are available to support research into the medical, social and public health aspects of moderate, hazardous or harmful alcohol consumption. Applications close in mid-September.

The Australian Coral Reef Society (ACRS) Inc Student Grants (L, I, R, C)

- $1,000 (plus $1,500 Walker prize for the best proposal)

The grant is open to students at any Australian University who are enrolled in a PhD or MSc involving research on coral reefs. Recipients must be a member of, or be willing to join the ACRS. Applications normally close in late November.

The Australian Federation of University Women (L, I, R, C)

Each year the Federation offers to its members a number of awards for study in Australia and overseas. Details of awards are included in a booklet available from the Australian Federation of University Women Inc, 8th Floor,

Dymocks Building, 428 George Street, Sydney NSW 2000 (tel 02 9232 5629).

The Australian Institute of Nuclear Science and Engineering (AINSE) Postgraduate Research Awards (L, I, R)

- $7,500 supplement to an APA or equivalent scholarship (see APA entry under General), plus allowances
- Up to 3 years

Applicants must be in receipt of an APA or equivalent scholarship and have completed (or expect to complete) a Bachelor of Engineering or Bachelor of Science with Honours. At least one quarter of the period of tenure must be spent at the Institute at Lucas Heights, NSW. Applications close in early December.

The Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART) Student Award (L, I, R, C)

- $1000 for attendance at the annual conference

Applicants can be postgraduate students from any discipline. The award provides assistance for a student to attend the annual conference. Applications are available from ANZCCART, PO Box 19, Glen Osmond, SA, 5064 (tel 08 303 7325). Applications close in July.

The Australian Pain Relief Association and Australian Pain Society PhD Scholarship (L, R)

- $16,750 pa plus allowances
- Up to 3 years (subject to satisfactory progress)

Applicants must hold an Honours 1 degree and be proposing to undertake a PhD in the mechanism, diagnosis, treatment or epidemiological features of acute or chronic (including cancer) pain. Further information and applications are available from the Australian Pain Society Secretariat, PO Box 629, Willoughby NSW 2068 (tel 02 9439 6744). Applications close in early November.

The Australian Telecommunications and Electronics Research Board (ATERB) Postgraduate Scholarships (L, R)

- $9,000 intended as a supplement to other awards
- 1 year with the possibility of renewal

Applicants must have graduated, or be proposing to graduate in the current academic year, with Honours 1 or equivalent. Preference will be given to applicants who are aged under 30 years as at 1 January and who are undertaking research in telecommunications transmission and terminal systems, telecommunications theory and applications, switching and signalling systems, software for telecommunications systems, integrated telecommunications and networking, distributed information systems and mobile communication. Applications are available from the Secretary, ATERB, PO Box 93, North Ryde, NSW 2113 (02 9887 8221). Applications normally close in late October.

The BHP Asia Pac Scholarship at UNSW (I, C)

- $10,000
- 1 year

The scholarship is open to citizens or permanent residents of Indonesia only. Applicants must be graduates of a recognised university who are eligible to enrol in a Master's by coursework degree at UNSW. The scholarship may be restricted to a particular coursework degree, to be determined. Selection will be based on academic merit, and the reasons for the proposed course of study, and may consider financial need. Applications close 31 October.

The Community Health and Anti-Tuberculosis Association - The Harry Windsor Biomedical and Medical Research Scholarship (L, R)

- $22,250 pa (Medical postgraduates), $15,364 - $19,827 pa (Biomedical Science graduates) plus allowances
- Up to 3 years

Applicants must be proposing to undertake medical research in the areas of tuberculosis, respiratory disease (particularly community aspects) or community health. Applications close in early August.

The Cooperative Research Centre for Eye Research and Technology (CRCERT) Postgraduate Research Scholarship (L, I, R)

- $15,321 - $19,827 pa (depending on the type of research)
- 3 years

The scholarship is available for full-time PhD studies in subjects such as optometry, microbiology, biochemistry, optics, materials science, polymer chemistry and immunology. Applicants should initially contact Dr Mark Wilcox, CRCERT, University of New South Wales, Sydney 2052 (02 9385 0222) for information about application procedures.

The Clean Air Society of Australia and New Zealand Inc Postgraduate Research Award (L, I, R, C)

- $5,000 pa
- I year, with a possible 1 year extension

The scholarship is open to students enrolled in a Masters degree program with a significant research component connected with air quality. Applications close in early February.

The CSIRO Division of Fisheries Supplementary PhD Awards (L, R)

- $10,000 pa
- Up to 3 years

This scholarship is a supplement to any primary scholarship (eg APA) for PhD study in marine studies, environmental studies, zoology, botany, broadly-based life sciences,

economics and mathematics. Applications close in early March.

The Dairy Research and Development Corporation (DRDC) Postgraduate Education Program (L, R)

Awards to undertake full-time postgraduate research degrees are available in a wide range of disciplines including dairy manufacturing, farm research, economics and marketing, and agricultural extension. New and experienced applicants are welcome to apply. Guidelines and applications are available from the Scholarships Unit or DRDC, PO Box 8000, Glen Iris VIC 3146 (03 9889 0577). Applications close 31 October.

The Energy Research and Development Corporation (ERDC) Postgraduate Awards (L, R, C)

- $21,000 pa plus $3,000 operating expenses to the institution
- Up to 3 years

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. Projects should be relevant to ERDC's objectives for its investments. Applications close in late September.

The Garnett Passe and Rodney Williams Memorial Foundation Research Scholarships in Otolaryngology (L, I, R)

- $15,364 pa for science graduates, $22,850 pa for medical graduates, plus allowances
- 3 years

The scholarships are available to medical or science graduates for research in Otolaryngology or in related fields of biomedical science. Applicants must be enrolled in a postgraduate degree in Australia or New Zealand. Information and applications are available from the Garnett Passe and Rodney Williams Memorial Foundation, Pelham House, 165 Bouverie St, Carlton VIC 3053. Tel (03) 9349 2622, Fax (03) 9349 2615. Applications normally close in August.

The Gerontology Foundation Grant-In-Aid (L, I, R, C)

- Up to $5,000 for a specific research project

A Grant-In-Aid is awarded to students who have not had their work published in a refereed journal and who have not won any research grants in open competition. The grant supports a proposed scientific investigation topic specified by the Foundation. Information and applications are available from The Executive Officer, Gerontology Foundation of Australia Inc, PO Box 199, Annandale NSW 2038. Applications normally close in late July.

The Gowrie Scholarship Trust Fund (L, R, C)

- $4,000 pa
- 2 years

Applicants must be members of the Forces or children (or grandchildren or lineal descendants) of members of the Forces who were on active service during the 1939-45 War. Tenable at tertiary institutions in Australia and overseas. Applications close in early October.

The Grains Research and Development Corporation (GRDC) Junior Research Fellowship (L, R)

- $21,000 pa plus up to $3,000 to the supporting institution, some conference/workshop attendance allowances
- Up to 3 years

Applicants must be undertaking full-time PhD studies in fields of high priority to the grains industry. Applications close in mid-October.

The Great Barrier Reef Marine Park Authority Research Support (L, I, R)

- $1,000

Applicants must be enrolled in a full-time PhD with a research project that could contribute to the planning and managing work undertaken by the Great Barrier Reef Marine Park Authority, and to the Reef's ecologically sustainable development. Studies may be in a variety of areas and can involve any aspect of the physical, biological, social, cultural, and economic environments of the Great Barrier Reef. Students proposing communication and extension-related studies can also apply. Applications and further information may be obtained from the Director, Research and Monitoring Section, Great Barrier Reef Marine Park Authority, PO Box 1379, Townsville QLD 4810 (07 7818811). Applications close in early December.

The Harold G. Conde Memorial Fellowship (L, R, C)

- $5,000 pa, subject to the availability of funds
- Up to 3 years

Applicants should be honours graduates. The Fellowship is a supplementary award to be held in conjunction with another scholarship and is for postgraduate study or research in a field related to the electricity industry. Applications close in early April.

The International Wool Secretariat Postgraduate Scholarships (L, I, R)

- $21,362 pa plus allowances
- Up to 3 years

The scholarships are tenable in Australian tertiary institutions or ,in exceptional circumstances, overseas. The major areas of research are soils and pastures- production and utilisation, sheep breeding, sheep parasites and diseases, wool harvesting, processing and product

development, raw wool marketing, economic research and technology transfer in all of these areas. Applications close in mid-October.

The June Opie Fellowship (L, I, R, C)

- NZD$10,000
- 1 year

The award is administered by the University of Auckland and is available to citizens and permanent residents of Australia, Canada and New Zealand, and is designed as an incentive for students of high academic achievement who have a severe disability. It is primarily intended for those who plan to undertake postgraduate study with a view to preparing themselves for a role in the professions, in politics or more particularly in university teaching and research and who have disability issues as a continuing interest. Applications close with the University of Auckland in early October.

Land and Water Resources Research and Development Corporation (LWRRDC) Postgraduate Research Scholarships (L, I, R)

- $20,000 pa plus $5,000 for operating expenses
- 2 years for Masters, 3 years for a PhD degree

General Research Scholarships are available for research that will lead to better management, sustainable use and conservation of land, water and vegetation resources in Australia. Irrigation Research Scholarships are specifically for research that will lead to better management, sustainable use and conservation of natural resources within the irrigation industries. Applications are available from the Scholarships Unit or LWRRDC, GPO Box 2182, Canberra ACT 2601 (tel 06 2573379). Applications close in early October.

The Meat Research Corporation (MRC) Studentships and Junior Research Fellowships (L, R, C)

- $14,961 pa for study in a Masters or Diploma, $20,000 for a PhD in Australia or $US17,500 for study overseas, plus airfares, insurance and allowances
- 2 years for Studentships (Masters or Diploma), 3 years for Junior Research Fellowships (PhD)

Applicants should be proposing to undertake research and training in "off-farm" disciplines of practical value to the Australian beef, sheep meat, goat meat and buffalo industries. Applications normally close in mid-August.

The Menzies Research Scholarship in the Allied Health Sciences (L, R)

- Up to $24,000 pa
- 2 years

The scholarship is awarded to stimulate research in the non-medical allied health disciplines. Applications close in mid-June.

The Minerals Council of Australia Student Research Award (L, I, R)

- $500, plus travel and accommodation for the Environmental Workshop

The award is open to scholars who have completed or are undertaking postgraduate studies, and is aimed at encouraging excellence in student research and communication in the field of environmental management related to mining. The award will be judged on a paper written for and presented at the Minerals Council of Australia's Environmental Workshop. Nominations usually close in early May.

The National Drug Strategy (NDS) Postgraduate Research Scholarship (L, I, R)

- $23,204 pa
- 1 year, with a possible 2 year extension

Scholarships are available to students undertaking PhD studies and aim to develop expertise in researching and evaluating non-biomedical approaches to the prevention and treatment of drug misuse. Selection is based on academic merit, work experience and the potential of the project. Applications close in mid-July.

The National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships (L, R)

- $15,364 - $22,850 pa (depending on qualifications)
- Up to 3 years

Applicants must be undertaking a course which includes, or leads to, research relevant to Aboriginal health. Applications close in mid-July.

The National Health and Medical Research Council (NH&MRC) Dora Lush Postgraduate Scholarships (L, R)

- $15,364 pa (or $19,307 for AIDS research, $17,364 for special initiative scholars) plus allowances
- Up to 3 years

Applicants should have completed a Science degree with Honours, or equivalent, at the time of submission of the application. Students enrolled in the Honours year at the time of application are **not** eligible. Applications close mid-July.

The National Health and Medical Research Council (NH&MRC) Medical and Dental Postgraduate Scholarships (L, R)

- $22,850 pa plus allowances
- Up to 3 years

The scholarships are open to medical and dental graduates. Applications are particularly encouraged for postgraduate research in the following fields - alcohol and substance abuse, prostate cancer, nursing and allied health services, breast cancer, dementia, schizophrenia,

dentistry and dental services, injury and HIV/AIDS. Applications close in mid-June.

The National Health and Medical Research Council (NH&MRC) Public Health Postgraduate Scholarships (L, R)

- $22,000 pa (medical postgraduates), $19,500 pa (other postgraduates), plus allowances
- Up to 2 years for Masters, and up to 3 years for a PhD

The scholarship is designed to enable postgraduate students to obtain formal academic training in public health research. Applications close in mid-June.

The National Heart Foundation of Australia Postgraduate Medical and Science Research Scholarships (L, R)

- $16,364 (science), $22,250 (medical) plus $1,200 departmental allowance
- 1 year, renewable up to 3 years

The scholarship is available for research in cardiovascular function, disease or related problems. Applicants must usually reside in Australia. Medical applications close in mid-May and Science applications close in early October.

The National Tertiary Education Union (NTEU) Scholarship for the Study of Industrial Relations and Unionism in Australian Tertiary Education (L, I, R)

- $5,000 pa
- Up to 3 years

Applicants must have made or intend to make an application for candidacy for a Masters by Research or PhD in a topic which covers some aspect of industrial relations, policy issues and/or unionism related to Australian tertiary education. Applications close in early November.

The National Multiple Sclerosis Society of Australia Postgraduate Research Scholarships (L, R)

- Same as NH&MRC scholarship stipends for medical and biomedical graduates
- Up to 2 years

Scholarships are available to medical graduates (or to appropriately qualified science graduates or health professionals) enrolled in a postgraduate research degree. Applications close in mid-July.

The NSW Ministry for the Arts Scholarships (L, R, C)

- $5,000 - $25,000 (depending on the award)

The NSW Government offers a number of scholarships and awards to writers, artists and scholars living in NSW. Further information is available from New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000. Tel (02) 9228 3533, Fax (02) 9228 4722.

The Pig Research and Development Corporation (PRDC) Postgraduate Research Fellowship (L, R)

- $25,000 pa plus allowances
- Up to 3 years

Applicants must be undertaking a PhD relevant to the increased competitiveness of the Australian pig industry. Applications close in mid-December.

The Pig Research and Development Corporation (PRDC) Postgraduate Top-Up Scholarships (L, R)

- Up to a maximum of $21,000 as a supplement to other scholarships, plus allowances.

Applicants must be eligible for another scholarship and be undertaking research relevant to increasing the competitiveness of the Australian pig industry. Applications close in mid-December.

The Re-Entry Scholarship for Women (L, I, R, C)

- $15,364 pa (equivalent to the Australian Postgraduate Award)
- 1 year

Applicants must be women who have been out of full-time paid professional employment for a period time and who wish to take up or resume a full-time research or coursework program of postgraduate study. Priority will be given to applicants wishing to update their research skills or to those who wish to gain further experience in order to return to employment in industry, business or education. Applicants must be able to demonstrate a well-planned career path. A written application and curriculum vitae should be forwarded to the Scholarships Unit, UNSW. Applications close 31 October.

The River Basin Management Society Ernest Jackson Memorial Research Grants (L, I, R)

- Up to $2,000

The scholarship assists PhD and Masters students undertaking research in the field of river basin management. Applications usually close in May and November each year.

The Ronald Henderson Postgraduate Scholarships (L, R)

- $5,000 pa as a supplement to an APA
- Up to 2 years for Masters by Research, 3 years for a PhD

The scholarships are open to graduates who intend to commence Masters or PhD studies in social economics, and who obtain an Australian Postgraduate Award or equivalent university postgraduate awards. Applicants may be enrolled in economics, commerce or arts degrees. Information and applications are available from the Ronald Henderson Research Foundation, 5th Floor, 165 Flinders Lane, Melbourne VIC 3000. Tel:(03) 9654 8299, Fax: (03)

9650 7501, E-mail: lance@creativeaccess.com.au. Applications close in late October.

The RSPCA Alan White Scholarship (L, I, R)

- $2,500

Applicants should be undertaking original research to improve the understanding and welfare of animals. Applications close in mid-March.

The Rural Industries Research and Development Corporation (RIRDC) Postgraduate Scholarships (L, R)

- $21,500 pa plus $3,500 to the host institution
- Up to 3 years

The scholarships are available for postgraduate study in rural research and development in areas of interest to the Corporation. Applicants must hold an Honours 1 or 2/1 degree in an appropriate discipline. Applications from mature age students with rural industry experience are particularly encouraged. Applications close in early November.

The Shell Postgraduate Scholarship (L, R)

- $20,000 pa
- Up to 3 years

Applicants should intend to study a PhD in science, engineering, economics/commerce, computer science, or a closely related discipline. Applications close in mid-October.

The Social Policy Research Centre (SPRC) Postgraduate Research Scholarship (L, I, R)

- $15,364 pa (equivalent to the APA), plus allowances
- 3 years for a PhD

Applicants should have a Bachelors Degree with at least Honours 2/1 in any of the fields of study relevant to social policy. The successful candidate will be enrolled in a relevant School of the University but will undertake research at the Centre. Prospective applicants must contact the School in which they wish to enrol. Application packages are available from the SPRC Publications and Information Officer, Social Policy and Research Centre, UNSW (02 385 3833). Applications close late October.

The State Librarian's Metcalfe Scholarship at UNSW (L, R, C)

- To be determined

The scholarship is open to suitably qualified librarian's for a Masters degree in the areas of librarianship, marketing or technology, in relevant Faculties at UNSW. Selection will be based on academic merit, outline for the proposed area of study and demonstrated interest in Librarianship. Applications normally close 30 November.

The Sugar Research and Development Corporation (SRDC) Postgraduate Scholarships (L, R)

- $22,000 pa plus $3,000 to the host institution
- Up to 3 years

The scholarships are available to foster research in disciplines compatible with the SRDC's research priorities. Applications close in mid-September.

The Telstra Research Laboratories Postgraduate Research Fellowship (L, R)

- $11,000 pa supplement to an Australian Postgraduate Award (see APA entry under General)
- Up to 2 years for Masters by Research, up to 3 years for a PhD

Applicants must be undertaking a Masters by Research or PhD in electrical engineering, computer science or other appropriate discipline. Applicants must have completed or expect to complete an appropriate degree with Honours or the equivalent. Applications close in mid-September.

The Wenkart Foundation Grants (L, I, R)

- Up to $22,000 pa
- 2 years but may be renewed

Applicants must be undertaking full-time research in clinical, biomedical or health related clinical sciences. Applications close in mid-May.

Faculty

Engineering

The Dexion Master of Business and Technology Scholarship (I, C)

- $10,000
- 1 year

The scholarship is available for full-time study toward a Master of Business and Technology in the Faculty of Engineering at UNSW. Candidates must be residents of Malaysia and have successfully completed their first degree at UNSW or an approved overseas university. Selection will be based on academic merit coupled with a statement outlining the reasons for their proposed study. Applications close in mid-September.

The Faculty of Engineering Research Scholarships (L, R)

- $15,364 pa (equivalent to an APA) plus allowances
- Up to 3 years

The scholarships are open to students proposing to enrol in a full-time PhD program in the School of Civil Engineering, Computer Science and Engineering, Electrical Engineering, Geomatic Engineering or Mechanical and Manufacturing Engineering, or the Graduate School of Biomedical Engineering. Applicants must have completed, or expect to complete, a Bachelor of Engineering degree with Honours 1 or 2/1 from a recognised institution. Applications are available from the Dean's Office, Faculty of Engineering, Rm 508 Geography and Surveying Building. Tel (02) 9385 5000, Fax (02) 9385 5456.

The Supplementary Engineering Postgraduate Awards (L, R)

- $8,000 pa (taxable) supplement to an APA

The awards may be available to students who are in receipt of an APA (see APA entry under General) and who are enrolled in a full-time PhD in the Faculty of Engineering at UNSW. Recipients will be required to undertake up to six hours per week of teaching and/or research assistance up to a total of 180 hours for the year. Information is available from the Faculty of Engineering Office, UNSW (02 9385 4329).

The Women in Engineering Research Scholarship (L, R)

- $15,364 pa (equivalent to an APA) plus allowances
- Up to 3 years

This scholarship is open to female students proposing to enrol in a full-time PhD program in the School of Civil Engineering, Computer Science and Engineering, Electrical Engineering, Geomatic Engineering, Mechanical and Manufacturing Engineering or the Graduate School of Biomedical Engineering. Applicants must have completed, or expect to complete, a Bachelor of Engineering degree with Honours 1 or 2/1 from a recognised institution. Applications are available from the Dean's Office, Faculty of Engineering, Rm 508 Geography and Surveying Building. Tel (02) 9385 5000, Fax (02) 9385 5456. Applications close in late November.

Computer Science and Engineering

The Supplementary Computer Science and Engineering Postgraduate Awards (I, R)

- $6,000 pa (taxable) supplement to an OPRS
- 1 year

The supplement may be made available to students who are in receipt of an Overseas Postgraduate Research Scholarship (see OPRS entry under General) and who are enrolled in a PhD or Masters by Research course in the School of Computer Science and Engineering at UNSW. Recipients will be required to undertake up to five hours per week of teaching and/or research assistance up to a total of 135 hours for the year. Information is available from the Postgraduate Clerk, School of Computer Science and Engineering (02 9385 4007). Applications close in late November.

Travel Scholarships

General

AAUW Educational Foundation International Fellowships (L, I, R, C)

- US$15,065
- 1 year

The American Association of University Women (AAUW) offers Fellowships for full-time postgraduate study or research in the United States for one academic year. Applicants must be females who have earned the equivalent of a United States Bachelor's degree and who are not US citizens or permanent residents. Preference will be given to women who show prior commitment to the advancement of women and girls through civic, community or professional work. Members of the Australian Federation of University Women (AFUW) may also be eligible for AAUW-IFUW awards for advanced training at any overseas institution. Application packs are available from the Scholarships Unit or the AAUW Educational Foundation, 2201 N. Dodge St, Dept 67, Iowa City, IA 52243 USA. Applications close in late November.

The ACSANZ Postgraduate Awards for Canadian Studies (L, I, R)

- $3,000 towards a research trip to Canada

The Association for Canadian Studies in Australia and New Zealand will offer grants to postgraduate students wishing to undertake a short research trip to Canada. Applicants must be enrolled in Master's or Doctoral degrees at Australian or New Zealand universities, and grants will be for research into all areas of academic enquiry that have a distinctly Canadian orientation, for example in the humanities, social and political sciences and some branches of the health and environmental sciences. Enquiries and applications should be directed to the Academic and Cultural Relations Officer, Canadian High Commission, Commonwealth Avenue, Canberra, ACT 2600. Tel (06) 273 3844, Fax (06) 270 4083, E-mail: co.cnbra@cnbra01.x400.gc.ca

The Asian Studies Library Awards (ASLA) (L, R)

- $250 to $800 in a lump sum

Applicants must be undertaking a Masters by Research or PhD. The award provides a contribution towards the travel costs to centres with Asian collections to undertake library research. Further information and application forms are available from the Project Co-ordinator, Asian Studies Library Awards, Collection Management Division, Library ANU, Canberra ACT 2600. Applications close in mid June.

The Association of International Education Japan (AIEJ) Short-Term Student Exchange Promotion Program (Inbound) Scholarships (L, I, R, C)

- 50,000 yen (settling-in allowance), 80,000 yen per month, plus airfare
- Six months to one year

Applicants must be accepted by a Japanese university under a student exchange program agreement with UNSW. Students must initially apply directly to a Japanese university through the International Student Centre at UNSW. The Japanese host university will recommend candidates to AIEJ and students must apply as directed by the host university. Applications close in February, May and September each year.

The Association of International Education Japan (AIEJ) Short-Term Student Exchange Promotion Program (Inbound) Peace and Friendship Scholarships (L, I, R, C)

- 50,000 yen (settling-in allowance), 100,000 yen per month, plus airfare
- Ten months to one year

Applicants must be accepted by a Japanese university under a student exchange program agreement with UNSW. Students must initially apply directly to a Japanese university through the International Student Centre at UNSW. The Japanese host university will recommend candidates to AIEJ and students must apply as directed by the host university. Applications close in February, May and September each year.

The Australian Bicentennial Scholarships and Fellowships Scheme (L, R, C)

- 4,000 pounds sterling
- At least 3 months

Applicants must be enrolled as postgraduate students at Australian higher education institutions and usually resident in Australia. Awards are available for study in the United Kingdom in any discipline. Applications close with the Executive Director, Australian Vice-Chancellors' Committee, GPO Box 1142, Canberra ACT 2601 in late October.

The Australian Federation of University Women (AFUW) (L, I, R, C)

Each year the Federation offers to its members a number of awards for study in Australia and overseas. Details of awards are included in a booklet available from the Australian Federation of University Women Inc, 8th Floor, Dymocks Building, 428 George Street, Sydney NSW 2000 (02 9232 5629).

The British Aerospace Australia Chevening Scholarship (L, R, C)

- Tuition fees, maintenance allowance, airfare
- 1 year

The scholarship is available to undertake an approved one-year MSc course in aerospace engineering at a British university. Applicants must hold, or expect to complete before October 1996, an Honours 1 or 2/1 degree. Application forms are available from the British Council, PO Box 88, Edgecliff NSW 2027. Tel (02) 9326 2022, fax (02) 9327 4868. Applications close late October.

The British Chevening Scholarship (L, R, C)

- Tuition fees, maintenance allowance and return airfare
- 3 months to 1 year

The awards are intended for outstanding graduates and young professionals with the potential to rise to senior positions in the private or public sectors and will contribute to Australian-British relations and understanding. The awards are tenable for postgraduate study at British universities. Application forms are available from the British Council, PO Box 88, Edgecliff NSW 2027, tel: (02) 9326 2022, fax (02) 9327 4868. Applications close in October.

The Cambridge Australia Scholarships (including Packer Scholarships) (L, R)

- Tuition fees, airfare, maintenance allowance
- Up to 3 years

The scholarships are open to postgraduate students who have an Honours 1 degree from an Australian university, who have gained admission to Cambridge and who are successful in winning an Overseas Research Student Award (ORS) awarded by Cambridge, for PhD studies in subjects relevant to Australia's needs. Scholarship application forms should be requested from Cambridge when applying for admission. Information on how to apply is available from the Honorary Secretary, Australian Committee of the Cambridge Commonwealth Trust, c/o Dept of Classics, ANU, Canberra ACT 0200. Tel (06) 249 2913/8830, Fax (06) 249 5039. Applications for admission to Cambridge close 31 December and scholarship applications close 30 April in the following year.

The Cancer Research Fellowship Programme (L, I, R)

- Travel expenses and living allowances
- 1 year

Applicants should be engaged in research in medical or allied sciences and intending to pursue a career in cancer research. The awards are tenable at the International Agency for Research on Cancer in France, or any other suitable institution abroad. Areas of research include epidemiology, biostatistics, environmental and viral carcinogenesis and mechanisms of carcinogenesis. Applications are available from the International Agency for Research on Cancer, 150 cours Albert-Thomas, 69372 Lyon Cedex 08, France, tel 72 73 84 85, fax 72 73 85 75. Applications normally close in December.

The Commonwealth Scholarship and Fellowship Plan (CSFP) (L, R, C)

- Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses.
- Usually 2-3 years depending on the country

CSFP provides opportunities for Commonwealth students to undertake advanced academic study in other Commonwealth countries. Candidates should be Commonwealth citizens who are graduates. Applications close at different times depending on the country in which the study is proposed.

The Coral Sea Scholarship (L, R, C)

- $3,000 per month, plus $2,500 travel entitlement
- Up to 3 months

The award is for applicants holding a tertiary qualification who are proposing study in the United States, to investigate a problem or opportunity relevant to Australian business or industry. Applicants must be Australian citizens (Permanent Residents are ineligible). Applications are available from the Program and Development Officer, Australian-American Foundation, GPO Box 1559, Canberra City ACT 2601 (06 247 9331). E-mail: lindy@aaef.anu.edu.au. Applications close 30 September.

DAAD- The German Academic Exchange Service Scholarships (L, I, R, C)

Application forms and information (including closing dates) for the following scholarships are available from the Consulate General of the Federal Republic of Germany, PO Box 204, Woollahra NSW 2025.

One-Year Scholarships

- Monthly allowance between DM1,000 and DM1,600, airfares, health and accident insurance, and tuition fees
- 1 year

Scholarships are available for graduate studies in Germany. Applicants must be aged 32 or under and hold a Bachelors degree (or equivalent). A working knowledge of German is required of those who study arts; others may receive additional language training prior to the commencement of the scholarship. Applications normally close in September.

Research Grants

- Monthly stipend of DM1,600, health insurance contribution and travel assistance of DM2,500
- 2 to 6 months

PhD students can apply for assistance to undertake a short period of research in Germany. Applicants must be aged 32 or under.

Information Visits by Groups of Professors and Students

Groups (minimum of 10 persons, maximum of 30 persons) of professors and students can apply for assistance to visit Germany with the intention of increasing the knowledge of specific German topics. The program offers support in making travel and study arrangements and may include some financial assistance (based on the length of the stay and the number of persons undertaking the study tour). The period of stay must be between 7 and 21 days. No tours will be organised for July or August.

Deutschlandkundlicher Winterkurs

- Course fees, DM3,500 to assist with travel and living expenses, health insurance
- 8 weeks (3 January - 21 February 1997)

Undergraduate and postgraduate students from all fields with at least two years university-level German may apply for this scholarship. Applicants must be Australian or New Zealand citizens, aged from 19 to 32 and proposing to undertake German studies course (in German) at the Albert-Ludwigs University of Freiburg. The course provides language instruction and concentrates on historical and cultural aspects of contemporary Germany for students with a background in German Studies. Applications usually close in early August.

East West Center Graduate Degree Fellowship (L, I, R, C)

- Accommodation, monthly stipend of US$600, tuition fees, health insurance plus allowances
- 12 months with a possible 1 year extension

The Fellowships are available for postgraduate study at the University of Hawaii, preferably at Masters level. Citizens of countries in Asia, the Pacific and the United States are eligible to apply. Potential applicants must request an application package direct from the East West Centre, Awards Services Officer, Burns Hall 2066, 1601 East-West Road, Honolulu Hawaii 96848-1601, USA. Tel 1 808 944 7735, Fax 1 808 944 7730. Information sheets only are available from the Scholarships Unit. Applications close in early October.

Frank Knox Memorial Fellowships (L, R, C)

- $US14,500 pa plus tuition fees and health insurance
- 1 year with the possibility of renewal for a further year.

Applicants must be undertaking, or near completion, of a postgraduate qualification at an Australian university. The scholarships are tenable at one of the graduate schools of Harvard University. Applications close in early October.

The Fulbright Postgraduate Student Awards (L, I, R)

- Up to $US24,000 depending on the type of award, with the possibility of other allowances (eg return airfares and tuition fees)
- 1 year

Applicants must be enrolled in a postgraduate degree at an Australian institution and wishing to undertake research at an American institution. Students planning to undertake an American higher degree in any field can apply for the **Fulbright Student Awards**. Students proposing to undertake study in engineering, visual and performing arts, statistics (and related disciplines) and the links between educational institutions, workplaces and communities or Aboriginal and Torres Strait Islander people can apply for the **Privately Sponsored Postgraduate Student Awards**. Students proposing study in an American Master of Business Administration can apply for the **David O. Anderson Scholarship** sponsored by the Chase Manhattan Bank Australia Ltd. Applicants for the David O. Anderson Scholarship should contact the Program Development Officer, AAEF, GPO Box 1559, Canberra ACT 2601 (06 2479331). Other applicants should contact the Honorary Secretary, Fulbright NSW State Selection Committee, Sydney University 2006 (02 93514464).

The Golda Meir Scholarship (L, I, R, C)

- Tuition (some allowances may be paid)
- 1 year

The Golda Meir scholarships are available to graduates, with a major field of study in Jewish studies, religious studies, Israel studies or Middle East studies, who meet the relevant requirements for the Graduate Year Program at the Hebrew University's Rothberg School for Overseas Students. Application forms are available from the Australian Friends of the Hebrew University, 36 Hawthorn Road, South Caulfield VIC 3162 (tel 03 9272 5511).

The Gowrie Scholarship Trust Fund (L, R, C)

- $4000 pa
- 2 years

Applicants must be members of the Forces or children (or grandchildren or lineal descendants) of members of the Forces who were on active service during the 1939-45 War. Applications close in early October.

The Harkness Academic Fellowships (L, R, C)

- Some allowances and tuition fees for study in the USA
- 12-21 months

The Academic Fellowships cover academic study and research. Applicants should be active in the public, business or voluntary sectors with an outstanding record of achievement. Special consideration may be given to studies in health care and related community issues. Applications are available on written request from the Harkness Fellowship, PO Box 836, Belconnen ACT 2606. Applications close in early September.

The Harkness Mid-Career Fellowships (L, R, C)

- Professional travel allowance
- 7-12 months

The Mid-career Fellowships are for study and practical experience. Applicants should be active in the public, business or voluntary sectors with an outstanding record of achievement. Special consideration may be given to

studies in health care and related community issues. Applications are available on written request from the Harkness Fellowship, PO Box 836, Belconnen ACT 2606. Applications close in early September.

The International Wool Secretariat Postgraduate Scholarships (L, I, R)

- $21,362 pa plus allowances
- Up to 3 years

The scholarships are tenable in Australian tertiary institutions or, in exceptional circumstances, overseas. The major areas of research are soils and pastures- production and utilisation, sheep breeding, sheep parasites and diseases, wool harvesting, processing and product development, raw wool marketing, economic research and technology transfer in all of these areas. Applications close in mid-October.

Japanese Government (Monbusho) Research Scholarships (L, R)

- Monthly allowance, airfare, tuition fees plus other allowances may be payable
- Up to 2 years

The scholarships are tenable for research study at Japanese universities, in a field related to the applicants' first course of study. Applicants must be university graduates, under 35 years of age, who are willing to study the Japanese language. Applications normally close in late June.

The Kobe Steel Postgraduate Scholarship (L, R, C)

- Maintenance allowance of at least 7,000 pounds sterling plus tuition fees and travelling expenses.
- Up to 2 years with the possibility of extension.

The scholarship is tenable at St Catherine's College, Oxford University. The scholarship will be awarded to outstanding individuals who display qualities of leadership, excellence in sport as well as academic ability. Students should have a past or future interest in Japan. Applications close in mid-October.

The Lady Davis Fellowship Trust (L, I, R, C)

The Lady Davis Trust provides awards for study, research, or teaching at graduate, post-doctoral or professorial levels at the Hebrew University or the Technion (Israel Institute of Technology). Information is available from the Australian Friends of the Hebrew University, 36 Hawthorn Road, South Caulfield VIC 3162 (03 9272 5511). Applications normally close in November.

The Lloyd's Register of Shipping Chevening Scholarship (L, R, C)

- Tuition fees, maintenance allowance, airfare
- 1 year

Two scholarships are available to graduates, of proven academic merit and leadership potential, to pursue a postgraduate course at a British university. One scholarship is for a one-year MSc course in Marine Engineering/Naval Architecture, and the other is for a one-year MSc course in Environmental Sciences. Applicants must hold, or expect to complete before October, an Honours 1 or 2/1 degree. Application forms are available from the British Council, PO Box 88, Edgecliff NSW 2027. Tel (02) 9326 2022, Fax (02) 9327 4868. Applications close late October.

The Meat Research Corporation (MRC) Studentships and Junior Research Fellowships (L, R, C)

- $14,961 pa for study in a Masters or Diploma, $20,000 for a PhD in Australia or $US17,500 for study overseas, plus airfares, insurance and allowances
- 2 years for Studentships (Masters or Diploma), 3 years for Junior Research Fellowships (PhD)

Applicants should be proposing to undertake research and training in "off-farm" disciplines of practical value to the Australian beef, sheep meat, goat meat and buffalo industries. Applications normally close in mid-August.

The Menzies Scholarships (L, R, C)

The Menzies Scholarships are intended to provide funds for Australian citizens (aged 21 to 45) who wish to travel to Britain to undertake a course of research and to write a paper, on a subject of concern and importance to the relationship between the Australian and British communities. Tertiary qualifications are preferred but the awards are not restricted to graduates or students. Information and applications are available from the Australia-Britain Society, GPO Box 551, Sydney NSW 2001 (02 223 5244). Applications normally close in October.

The NSW Ministry for the Arts Scholarships (L, R, C)

- $5,000 - $25,000 (depending on the award)

The NSW Government offers a number of scholarships and awards to writers, artists and scholars living in NSW. Further information is available from New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000. Tel (02) 9228 3533, Fax (02) 9228 4722.

The Oxford Nuffield Medical Fellowship (L, R)

- Between 27,525 and 31,945 pounds sterling pa (subject to tax), plus travel expenses
- 2 years with a possible 1 year extension

The awards are available for research in a clinical medicine or medical science department of the University of Oxford. The appointee is required to return to Australia for at least 3 years to perform work similar to that carried out in the United Kingdom during the tenure of the Nuffield fellowship. Further information is available from Australian Academy of Science, GPO Box 783, Canberra City ACT 2601. Tel

(06) 247 5777, Fax (06) 257 4620. Applications close in mid-March.

Overseas Research Students Awards Scheme (United Kingdom) (L, I, R)

- Difference in tuition fees for a 'home' and an 'overseas' student

The ORS Scheme provides partial remission of tuition fees to overseas students of outstanding merit and research potential. The awards are open to graduates who will be commencing full-time research studies at a participating institution in the United Kingdom, and who will be liable to pay tuition fees at the overseas student rate. Information and applications must be obtained directly from the Registrar or Secretary of the institution students are applying to in the United Kingdom. Applications normally close in April in the year of tenure.

The Rhodes Scholarship (L, R, C)

- Not less than 6,900 pounds sterling pa, tuition fees and assistance with travel expenses
- 2 years, with a possible 1 year extension

The scholarship is tenable at Oxford University. Applicants must be aged between 19 and 25 and have an honours degree or equivalent. Selection for the scholarship will be based on academic and personal achievements, including community spirit. Applications close in late August.

The Robert Gordon Menzies Scholarship to Harvard (L, R, C)

- Up to $25,000 towards tuition fees, living expenses or travel costs, students who enrol in the Harvard Business School may be eligible for an additional $12,000
- 1 year

The scholarships are tenable at one of the graduate schools of Harvard University. Applicants must be postgraduates of an Australian tertiary institution who intend to return to Australia after studies at Harvard or to represent Australia overseas. The scholarships are awarded on the basis of academic excellence and personal qualities such as leadership and public duty. The successful applicant will be expected, when circumstances permit, to repay the scholarship in later years. Applications and additional information may be obtained from the Administrative Services Group, ANU, Canberra ACT 0200. Tel (06) 249 5444, E-mail: Jane.Sutton@anu.edu.au. Applications close at the end of December.

The STA Travel Grant (L, I, R, C)

- Up to $3000

Applicants must be undertaking study leading to a degree or diploma of the University and a member of the University Union. The grant is awarded on the basis of significant contribution to the community life of the University involving a leadership role in student affairs and the University Union and the relevance and merit of the proposed travel to the student's academic program or University Union activities. Applications close in mid-April.

Yokahama Scholarship Awards (L, R, C)

- JPY 120,000 per month undergraduate, JPY 150,000 per month for postgraduate students, tuition fees, airfare plus allowances
- Up to 4 years (undergraduate), 1 year for Japanese language study, 2 years for a Masters, 3 years for a PhD

Applicants must have submitted their application to, or have been accepted by a Japanese university and be able to communicate in Japanese (or be willing to undertake intensive study of the Japanese language). Applicants in all disciplines are eligible except for medicine, veterinary science and dentistry. Scholarships will be granted subject to the applicant's final acceptance by the chosen Japanese university. Original application forms only will be accepted and are available from the Scholarships Unit or from the Yokahama Scholarship Foundation, tel (07) 5588 0880, fax (07)5588 0842. Applications close with the Foundation in early October.

Prizes

The following information summarises 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, school or department in which they are awarded. Law prizes are awarded only for students enrolled in the LLB or Jurisprudence courses.

Information regarding the establishment of new prizes may be obtained from the Student Information and Systems Office located on the Ground Floor of the Chancellery.

The scholarship information is normally provided in the following format:

- Amount
- Conditions

Undergraduate Prizes

The University of New South Wales (General category for Prizes)

The Sydney Technical College Union Award

- $400.00 and a bronze medal

Leadership in student affairs combined with marked academic proficiency by a graduand

Human Rights Centre

The UNSW Human Rights Centre Essay Prize

- $400.00

The best research essay on a Human Rights topic by a student enrolled at the University of New South Wales proceeding to the award of a Bachelor degree

Faculty of Engineering

The Institution of Engineers Australia Award

- $500.00

The best performance by a final or equivalent year student in the Bachelor of Engineering or Bachelor of Science (Engineering) 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

- $130.00

The best performance in Year 1 or part-time equivalent of a Bachelor degree course offered by the Faculty of Engineering

School of Civil Engineering

The Association of Consulting Structural Engineers of New South Wales Prize

- $250.00

The best performance in CIVL4203 Structural Engineering in the Bachelor of Engineering degree course in Civil Engineering

The Australian Institute of Traffic Planning and Management Prize

- $200.00, a 1 year free subscription to AITPMand a plaque

The best performance in CIVL4844 Transport Major in the Bachelor of Engineering degree course in Civil Engineering

The Baulderstone Hornibrook Prize

- $500.00

The best performance in Engineering Construction and Management in the Bachelor of Engineering degree course in Civil Engineering

The Computing and Graphics Prize

- $400.00

The best performance in CIVL1106 Computing and Graphics by a student in the Bachelor of Engineering degree course in Civil Engineering or Environmental Engineering

The Crawford Munro Memorial Prize

- $300.00

The best performance in CIVL3705 Water Resources in the Bachelor of Engineering degree course in Civil Engineering

The Hardie's Pipeline Award

- $500.00 and a plaque

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

- $200.00

The best performance in CIVL1007 Engineering Practice in the Bachelor of Engineering degree course in Environmental Engineering

The Jeffery and Katauskas Prize

- $500.00

The best performance in CIVL3402 Geotechnical Engineering 1 by a student in the Bachelor of Engineering degree course in Civil Engineering or Bachelor of Environmental Engineering degree course

The Sydney Water Gold Medal

- $200.00 and a gold medal

The highest aggregate in CIVL4017 Water Engineering (Major) in the Bachelor of Engineering in Environmental Engineering degree course

The TDA Timber Engineering Prize

- Books to the value of $150.00

The best performance in Timber Engineering or Timber Related Project for all students proceeding to the degree of Bachelor of Engineering in Civil Engineering or Bachelor of Engineering in Environmental Engineering

The Welding Technology Institute of Australia Prize

- Books from WTIA valued at $200.00and a 1 year free membership to the Institute

The best performance in CIVL4403 Materials Engineering 2

School of Electrical Engineering

The Electricity Supply Engineers' Association Prize

- $200.00

The best overall performance including proficiency in electric power distribution in Year 3 full-time or equivalent part-time stages of the Bachelor of Engineering degree course in Electrical Engineering

The Institution of Electrical Engineers UK Prize

- $250.00. One hundred pounds sterling, an IEE certificate and two years free Associate Membership of IEE

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

- Book order to the value of $60.00

Outstanding performance in the field of Control Systems in the final year of the Bachelor of Engineering degree course in Electrical Engineering

The Photovoltaics Prize (Advanced Photovoltaics)

- $500.00

The best performance in ELEC9505 Solar Cells leading to the award of the degree of Bachelor of Engineering, Master of Engineering Science or Doctor of Philosophy

The Photovoltaics Prize (Applied Photovoltaics)

- $500.00

The best performance in ELEC4540 Applied Photovoltaics in the Bachelor of Engineering degree course

The Photovoltaics Thesis Prize

- $500.00

The best performance for an undergraduate thesis in the area of photovoltaics in the Bachelor of Engineering degree course

The Telstra Prize

- $300.00

The best telecommunications related thesis by a final year student proceeding to the award of the degree of Bachelor of Engineering in Electrical Engineering or Computer Engineering

School of Geomatic Engineering

The Angus-Leppan Prize

- $300.00

The best performance in Spatial Information System subjects in the Bachelor of Surveying course or Bachelor of Engineering course in Geomatic Engineering

The Association of Consulting Structural Engineers of New South Wales Prize

- $200.00

The best performance in CIVL3303 Structural Design in the Bachelor of Engineering degree course in Civil Engineering

The Australian Photogrammetric and Remote Sensing Society (NSW) Prize

- $150.00

The best performance in Photogrammetric subjects in the Bachelor of Surveying degree course or Bachelor of Engineering degree course in Geomatic Engineering

The BHP Engineering Prize in Surveying

- $2,000.00

The best overall performance by a third year student proceeding to fourth year in the Bachelor of Surveying degree course or Bachelor of Engineering degree course in Geomatic Engineering

The Board of Surveyors Medal

- A medal

Oustanding performance in the final year of the Bachelor of Surveying degree course or Bachelor of Engineering degree course in Geomatic Engineering

The Bowdens Prize for Management

- $2,500.00

Superior performance in management subjects and contributions to student or community activities by a student proceeding to the degree of Bachelor of Surveying or Bachelor of Engineering in Geomatic Engineering

The Consulting Surveyors NSW Prize in Land Development

- $500.00

The best performance in Land Management and Development Project 1 and 2 by a student who is also Student Member of the Institution of Surveyors.

The Institution of Surveyors New South Wales Incorporated Prize

- Books to the value of $200.00 and an inscribed plaque

The best performance in the graduating year of the Bachelor of Surveying degree course or the Bachelor of Engineering degree course in Geomatic Engineering

The Land Information Centre Prize

- $1,000.00

The best overall performance by a second year student proceeding to third year in the Bachelor of Surveying degree course or the Bachelor of Engineering degree course in Geomatic Engineering

The R S Mather Memorial Prize

- $250.00

Outstanding performance in Geodesy subjects in the Bachelor of Surveying course or the Bachelor of Engineering course in Geomatic Engineering

The School of Geomatic Engineering Prize

- $2,000.00

The best overall performance by a first year student proceeding to second year in the Bachelor of Surveying degree course or the Bachelor of Engineering degree course in Geomatic Engineering

School of Mechanical and Manufacturing Engineering

The ABB Power Generation Prize

- Book voucher for $100.00

The best performance in MECH1400 Mechanics of Solids 1

The Atlas Copco Prize

- $125.00

The best overall performance in the Bachelor of Engineering degree course in Mechanical Engineering

The Carrier Air Conditioning Pty Limited Prize

- $250.00

The best performance in MECH2700 Thermodynamics 1

The Computer-based Engineering Design Prize

- $100.00

The best undergraduate thesis making a contribution to computer-based Engineering design in the School of Mechanical and Manufacturing Engineering

The David Carment Memorial Prize

- $500.00 and a bronze medal

The best overall performance in the final year of the Bachelor of Engineering degree course in Naval Architecture

The Jeremy Hirschhorn Prize in Mechanical Engineering

- $100.00

The best performance in MECH2100 Mechanical Engineering Design 2

The John Harrison Prize

- $100.00

The best performance in MECH3300 Engineering Mechanics 3

The Pacific Power Award

- $250.00

The best performance in MECH4740 Thermal Power Plants

The R E Jeffries Memorial Prize

- $500.00

The best overall performance in the final year of the Bachelor of Engineering degree course in Manufacturing Management

The RAA Bryant Prize

A student graduating with First Class Honours and the University Medal in Mechanical Engineering

The Royal Institution of Naval Architects (Australian Division) Prize

- $250.00

The best ship design by a student in the final year of the Bachelor of Engineering degree course in Naval Architecture

The Shell Refining (Australia) Pty Limited Prize

- $100.00

The best performance in MECH1400 Mechanics of Solids 1

The Shell Refining (Australia) Pty Limited Prize

- $100.00

The best performance in MANF3400 Engineering Economics by a student in the Bachelor of Engineering degree course

The Shell Refining (Australia) Pty Limited Prize

- $100.00

The best performance in a subject selected by the Head of School

The Shell Refining (Australia) Pty Limited Prize

- $100.00

The best undergraduate thesis by a student in the final year of the Bachelor of Engineering degree course in Mechanical Engineering

The Spruson and Ferguson Prize (for MECH3100)

- $250.00

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 Limited Prize

- Products to the value of $350.00

The best overall performance by a student in second year of the Bachelor of Engineering degree course in Mechanical Engineering

The Warwick Slade Royal Aeronautical Society Prize

- Student membership of the Royal Aeronautical Society to each member of the top team, with the top student from the team also to receive a Royal Aeronautical Society medal

For the top team performance in AERO4100 Aerospace Design

Department of Electric Power Engineering

The Energy Australia Electrical Energy 3rd Year Prize

- $500.00

The best combined performance in subjects in electric power engineering in year 3 of the electrical engineering course

The Energy Australia Electrical Energy 4th Year Prize

- $500.00 and a silver medal

The best combined performance in final year subjects and thesis offered by the Department of Electric Power Engineering

Undergraduate and Graduate Prizes

School of Civil Engineering

The Maunsell Project Report Prize

- $500.00

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 course

The Maunsell Waste Management Prize

- $500.00

The best aggregate score in CIVL8872/9872 Solid Waste Management and CIVL8881/9881 Hazardous Waste Management by a student in the Master of Engineering Science or Master of Applied Science degree courses

The University of New South Wales • Kensington Campus

Theatres

Athol Lykke Theatre **C27**
Biomedical Theatres **E27**
Central Lecture Block **E19**
Chemistry Theatres
(Dwyer, Mellor, Murphy, Nyholm, Smith) **E12**
Classroom Block *(Western Grounds)* **H3**
Fig Tree Theatre **B14**
Io Myers Studio **D9**
Keith Burrows Theatre **J14**
MacAuley Theatre **E15**
Mathews Theatres **D23**
Parade Theatre **E3**
Physics Theatre **K14**
Quadrangle Theatre **E15**
Rex Vowels Theatre **F17**
Science Theatre **F13**
Sir John Clancy Auditorium **C24**
Webster Theatre **G15**

Buildings

Applied Science **F10**
Arcade **D24**
Architecture **H14**
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**
Heffron, Robert *(Chemistry)* **E12**
International House **C6**
John Goodsell *(Commerce and Economics)* **F20**
Kensington Colleges *(Office)* **C17**
Library *(University)* **E21**
Link **B6**
Main, Old **K15**
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**
Pavilions **E24**
Philip Baxter College *(Kensington)* **D14**
Quadrangle **E15**
Sam Cracknell Pavilion **H8**
Samuels Building **F25**
Shalom College **N9**
Webster, Sir Robert **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 Resource & Research Centre **E20**
Aboriginal Student Centre **A29**
Accommodation *(Housing Office)* **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: 45 Beach Street Coogee
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**
Centre for Membrane Science & Technology **F10, K14**
Chaplains **E4**
Chemical Engineering and Industrial Chemistry **F10**
Chemistry **E12**
Civil Engineering **H20**
Co-op Bookshop **E15**
Commerce and Economics *(Faculty Office)* **F20**
Communications Law Centre **C15**
Community Medicine **D26**
Computer Science and Engineering **G17**
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**
Equal Employment Opportunity: 30 Botany Street
Randwick
Examinations **C22**
Facilities Department **C22, B14A**
Fees Office **C22**
Fibre Science and Technology **G14**
Food Science and Technology **B8**
French **C20**
Geography **K17**
Geomatic Engineering **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 **F25**
History **C20**
Human Resources **C22**
Industrial Design **G14**
Industrial Relations and Organizational Behaviour **F20**
Information, Library & Archives Studies **F23**
Information Systems **E15**
Information Technology Unit **F25**
International Student Centre **F9**
IPACE Institute **F23**
Japanese Economic and Management Studies **E15**
Landscape Architecture **K15**
Law *(Faculty Office)* **F21**
Law Library **F21**
Legal Studies & Taxation **F20**
Liberal and General Studies **C20**
Library Lawn **D21**
Lost Property **C22**
Marine Science **D26**
Marketing **F20**
Materials Science and Engineering **E8**
Mathematics **F23**
Mechanical and Manufacturing Engineering **J17**
Media Liaison **C22**
Medical Education **C27**
Medicine *(Faculty Office)* **B27**
Microbiology and Immunology **D26**
Michael Birt Gardens **C24**
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**
Psychology **F23**
Publications Section **C22**
Remote Sensing **K17**
Research Office: 34-36 Botany Street Randwick
Safety Science **B11a**
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, Housing etc **E15**
Counselling **E15**
Students' Guild **E15**
Swimming Pool **B4**
Textile Technology **G14**
Theatre and Film Studies **B10**
Town Planning **K15**
WHO Regional Training Centre **C27**
Wool and Animal Sciences **G14**
Works and Maintenance **B14A**