THE UNIVERSITY OF
NEW SOUTH WALES

Faculty of Engineering

HANDBOOK

1999

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Introduction

This Handbook provides information about undergraduate and postgraduate courses offered by the Faculty of Engineering at UNSW. It also contains descriptions of the subjects offered and lists areas in which research may be undertaken.

The Faculty comprises the Schools of Chemical Engineering and Industrial Chemistry, Civil and Environmental Engineering, Computer Science and Engineering, Electrical Engineering and Telecommunications, Geomatic Engineering, and Mechanical and Manufacturing Engineering, Mining Engineering and Petroleum Engineering as well as the Graduate School of Biomedical Engineering and the Graduate Programs in Business and Technology. The Faculty has several research Centres and is also actively engaged with nine co-operative Research Centres (CRC's).

The Faculty of Engineering is dedicated to scholarship, teaching and research in technology and their application for the benefit of the community. The Schools of the Faculty offer undergraduate courses leading to the award of the Bachelor of Engineering (BE). There are also numerous combined courses leading to the award of the BE in combination with the BSc BA and LLB degrees and concurrent courses for the BE and the Master of Biomedical Engineering as well as'fast-track' programs leading to the Master of Commerce following an Engineering undergraduate course..

Postgraduate study in the Faculty can lead to the award of Graduate Diplomas and coursework Masters degrees as well as Masters and PhD degrees by research.

The Faculty is committed to developing the scientific, technical and creative skills of its students. Courses also focus on skills and knowledge required to direct and manage engineering activities. These latter require an ability to work in teams, an understanding of human and physical environments and a highly developed skill in communication with other members of the profession and the public.

In order to develop innovation and a reappraisal of current practice, the Faculty provides postgraduate courses for the continuing education of its graduates.

As part of the development of the engineering professional, the Faculty encourages its students to play an active part in the entire life of the University. Student activities and professional organisations are amongst the opportunities to do this.

MS Wainwright
Dean
Faculty of Engineering

Faculty of Engineering Websites

Faculty of Engineering
http://www.eng.unsw.edu.au

School of Chemical Engineering and Industrial Chemistry
http://www.ceic.unsw.edu.au

School of Civil and Environmental Engineering
http://www.civeng.unsw.edu.au

School of Computer Science and Engineering
http://www.cse.unsw.edu.au

School of Electrical Engineering and Telecommunications
http://www.ee.unsw.edu.au

School of Geomatic Engineering
http://www.gmat.unsw.edu.au

School of Mechanical and Manufacturing Engineering
http://www.eng.unsw.edu.au

School of Mining Engineering
http://www.mines.unsw.edu.au

School of Petroleum Engineering
http://www.petrol.unsw.edu.au

Graduate School of Biomedical Engineering
http://www.gsbme.unsw.edu.au

Graduate Programs in Business and Technology
http://Mbt.web.unsw.edu.au

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, ADFA

	1999	2000
Session 1		
(14 weeks)	1 March to 1 April 12 April to 11 June	28 February to 20 April 1 May to 9 June
Mid-session recess	2 April to 11 April	21 April to 30 April
Study period	12 June to 17 June	10 June to 14 June
Examinations	18 June to 6 July	15 June to 29 June
Mid-year recess	7 July to 25 July	30 June to 16 July
Session 2		
(14 weeks)	26 July to 24 September 5 October to 5 November	17 July to 10 September 7October to 17 November
Mid-session recess	25 September to 4 October	11 September to 6 October
Study period	6 November to 11 November	18 November to 22 November
Examinations	12 November to 30 November	23 November to 7 December

Important dates for 1999

January 1999

F 1 New Year's Day - Public Holiday
M 11 Medicine IV - Term 1 begins
Th 14 Medicine V - Term 1 begins
T 26 Australia Day - Public Holiday

February 1999

M 8 AGSM EMBA GMQ and GDM Programs - Session 1 begins
M 22 AGSM MBA Program - Year 1 classes - Term 1 begins
Medicine VI - Term 2 begins

March 1999

M 1 Session 1 begins - for Faculties other than Medicine, AGSM and University College, ADFA
University College, ADFA - Session 1 begins
AGSM MBA Program - Year 2 classes - Term 1 begins
F 12 Last day applications are accepted from students to enrol in Session 1 or whole year subjects
S 14 Medicine IV - Term 1 ends
M 15 Medicine IV - Term 2 begins
Su 21 Medicine V - Term 1 ends
M 29 Medicine V - Term 2 begins
W 31 Last day for students to discontinue without failure subjects which extend over Session 1 only
HECS Census Date for Session 1

April 1999

F 2 Mid-session recess begins - for Faculties other than Medicine, AGSM and University College, ADFA
Good Friday - Public Holiday
S 3 Easter Saturday
Su 4 Easter Sunday
Su 11 Mid-session recess ends - for Faculties other than Medicine, AGSM and University College, ADFA
Medicine VI - Term 2 ends
M 12 Medicine VI - Recess begins
Su 18 Medicine VI - Recess ends
M 19 Medicine VI - Term 3 begins
Su 25 Medicine IV - Term 2 ends
M 26 Anzac Day - Public Holiday

May 1999

S 1 University College, ADFA - Mid-session recess begins
Su 2 Medicine IV - Recess ends
M 3 Medicine IV - Term 3 begins
F 7 AGSM MBA Program - all classes - Term 1 ends
M 10 AGSM MBA Program - all classes - Examinations begin
T 11 Publication of provisional timetable for June examinations
F 14 AGSM MBA Program - all classes - Examinations end
Su 16 University College, ADFA - Mid-session recess ends
M 17 AGSM EMBA GDM Programs - Session 1 ends
S 22 AGSM EMBA GDM Program - Examination
M 24 AGSM EMBA GMQ Programs - Session 1 ends
S 29 AGSM EMBA GMQ - Examination
Su 30 Medicine V - Term 2 ends
Medicine VI - Term 3 ends
M 31 Medicine VI - Term 4 begins
AGSM MBA Program - all classes - Term 2 begins

June 1999

T 1 Publication of timetable for June examinations
M 7 Medicine V - Term 3 begins
F 11 Session 1 ends - for Faculties other than Medicine, AGSM and University College, ADFA
S 12 Study period begins - for Faculties other than Medicine, AGSM and University College, ADFA
Su 13 Medicine IV - Term 3 ends
M 14 Queen's Birthday - Public Holiday
T 15 Medicine IV - Term 4 begins
Th 17 Study period ends - for Faculties other than Medicine, AGSM and University College, ADFA
F 18 Examinations begin - for Faculties other than Medicine, AGSM and University College, ADFA
M 21 University College, ADFA - Examinations begin

July 1999

S 3 University College, ADFA - Examinations end
Su 4 University College, ADFA - Mid-year recess begins
T 6 Examinations end - for Faculties other than Medicine, AGSM and University College, ADFA
W 7 Mid-year recess begins - for Faculties other than Medicine, AGSM and University College, ADFA
M 12 AGSM EMBA GMQ and GDM Programs - Session 2 begins
Su 18 University College, ADFA - Mid-year recess ends
M 19 University College, ADFA - Session 2 begins
F 23 Medicine VI - Term 4 ends
S 24 Medicine VI - Recess begins
Su 25 Mid-year recess ends - for Faculties other than Medicine, AGSM and University College, ADFA
M 26 Session 2 begins - for Faculties other than Medicine, AGSM and University College, ADFA

August 1999

S 1 Medicine VI - Recess ends
M 2 Medicine VI - Term 5 begins
F 6 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
Su 8 Medicine IV - Term 4 ends
Medicine V - Term 3 ends
M 9 Medicine IV - Recess begins
F 13 AGSM MBA Program - all classes - Examinations end
Su 15 Medicine IV - Recess ends
M 16 Medicine IV - Term 5 begins
M 30 AGSM MBA Program - all classes - Term 3 begins
T 31 Last day for students to discontinue without failure subjects which extend over Session 2 only
HECS Census Date for Session 2

September 1999

S 4 Open Day
Su 12 Medicine VI - Term 5 ends
M 13 Medicine VI - Term 6 begins
F 24 Closing date for applications to the Universities Admission Centre
S 25 Mid-session recess begins - for Faculties other than Medicine, AGSM and University College, ADFA
University College, ADFA - Mid-session recess begins
Su 26 Medicine IV - Term 5 ends
M 27 Medicine IV - Term 6 begins

October 1999

M 4 Labour Day - Public Holiday
Mid-session recess ends - for Faculties other than Medicine, AGSM and University College, ADFA
University College, ADFA - Mid-session recess ends
T 5 Publication of provisional timetable for the November examinations
W 13 Last day for students to advise of examination clashes
Su 17 Medicine V - Term 4 ends
M 18 AGSM EMBA GDM Program - Session 2 ends
F 22 University College, ADFA - Session 2 ends
S 23 AGSM EMBA GDM Program - Examination
Su 24 Medicine VI - Term 6 ends
M 25 University College, ADFA - Examinations begin
AGSM EMBA GMQ Program - Session 2 ends
S 30 AGSM EMBA GMQ Program - Examination

November 1999

F 5 Session 2 ends - for Faculties other than Medicine, AGSM and University College, ADFA
S 6 Study period begins - for Faculties other than Medicine, AGSM and University College, ADFA
Su 7 Medicine IV - Term 6 ends
M 8 AGSM MBA Program - all classes - Examinations begin
Th 11 Study period ends - for Faculties other than Medicine, AGSM and University College, ADFA
F 12 Examinations begin - for Faculties other than Medicine, AGSM and University College, ADFA
University College, ADFA - Examinations end
AGSM MBA Program - all classes - Examinations end
T 30 Examinations end - for Faculties other than Medicine, AGSM and University College, ADFA

December 1999

S 25 Christmas Day
M 27 Boxing Day - Public Holiday

Staff

Comprises Schools of Chemical Engineering and Industrial Chemistry, Civil and Environmental Engineering, Computer Science and Engineering, Electrical Engineering and Telecommunications, Geomatic Engineering, Mechanical and Manufacturing Engineering (incorporating Aerospace Engineering, Mechatronic Engineering and Naval Architecture), Mining Engineering, Petroleum Engineering, the Graduate School of Biomedical Engineering and Graduate Programs in Business and Technology. Other Centres in the Faculty are the Centres for Advanced Numerical Computation in Engineering and Science, Applied Polymer Science, Minerals Engineering, Particle and Catalyst Technologies, Photovoltaic Devices and Systems, Manufacturing and Automation, Water and Waste Technology,and the Munro Centre for Civil and Environmental Engineering. The Faculty is also associated with the Centre for Remote Sensing and Geographic Information Systems, the UNESCO Centre for Membrane Science and Technology, the UNSW Groundwater Centre, Australian Photonics Co-operative Research Centre, and the Co-operative Research Centres for Waste Management and Pollution Control, and Aerospace Structures.

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Colin Grantham, BSc PhD *N'cle.(U.K.)*, CPEng, FIEE
Hugh Ronald Outhred, BSc BE PhD *Syd.*, AMIEE, FIEAust, MIEEE

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Fazlur Muhammed Rahman, BScEng *BUET(Ban)*, MSc PhD *UMIST*, MIEEE, AMIEE, MISA

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Roland John Kaye, BE MEngSc *Melb.*, PhD *Calif.*, MIEEE

Project Scientist
Edward Douglas Spooner, ME *UNSW*

Professional Officers
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Bao Toan Phung, BE *W'gong*, MEngSc *UNSW*

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Ronald Edward James, BSc(Eng) PhD *Lond.*, CPEng, CEng, FIEAust, MIEE, MIMechE, SMIEEE

Visiting Fellow
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Department of Electronics

Professor and Head of Department
Stuart Ross Wenham, BE BSc PhD *UNSW*, SMIEEE

Professors
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Graham Austin Rigby, Msc *Melb*, Phd *Calif*, CPEng, CEng, FTS, FIREE, MIEEE, FIEAust

Associate Professors
Paul Austin Basore, BS *Oklahoma*, MS, PhD *M.I.T.*, MIEEE
Chee Yee Kwok, BSc BE PhD *UNSW*, MIEEE

Senior Lecturer
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Professional Officers
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Mark Gross, BSc PhD *Syd.*

Department of Systems and Control

Professor and Head of Department
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Associate Professors
Timothy Hesketh, MScEng *CapeT.*, PhD Massey, MIEEE
Khiang Wee Lim, BE *Malaya*, DPhil *Oxf.*, SMIEEE
Peter Douglas Neilson, BScEng PhD *UNSW*

Senior Lecturers
David James Clements, BSc *Qld.*, ME PhD *N'cle.(N.S.W.)*, MIEEE, MSIAM, SigmaXi
Gang (Gary) Feng, MEng *Nanjing Aero.Inst.*, PhD *Melb.*, SMIEEE

Lecturer
Boshra Dawoud Farah, BScEng *Alexandria*, Dr-Ing K. M. *Stadt (TU.Chemnitz)*, CPEng, MIEAust, MIEEE

Professional Officers
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Christopher Xiaolong Lu, MScEng *Beijing*, MIEEE

Photovoltaics Special Research Centre

Director
Professor M. A. Green

Associate Directors
Professor SR Wenham
Associate Professor PA Basore
Associate Professor HR Outhred
Dr AG Aberle

School of Geomatic Engineering

Professor and Head of School
John Charles Trinder, BSurv PhD *UNSW,* MSc *I.T.C. Delft,* FISAust, FIEAust

Associate Professors
Arthur Harry William Kearsley, MSurvSc PhD *UNSW,* MISAust, FIEAust
Christopher Rizos, BSurv PhD *UNSW*
Jean Marc Rueger, DipIng E.T.H. Zurich, PhD *UNSW,* ACSM, LSSwitz, MISAust, FIEAust

Senior Lecturers
Bruce Raymond Harvey, BSurv GradDipHEd PhD *UNSW,* MIS Aust
Ewan Gerald Masters, BSurv PhD *UNSW,* MISAust

Lecturers
Shao Wei Han, MSc *WTUSM,* PhD *UNSW*
Lihua Li, MSc *AIT,* MEng *WTUSM*

Administrative Officer
Leon Daras, BA UNSW

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Philip Hong Lam, BE(Geom.Eng.) *UNSW*

Visiting Professor
Bruce Crosby Forster, MSurv *Melb.,* MSc *R'dg.,* PhD *UNSW,* MISAust, LSVic, MIEEE, FIEAust

Visiting Fellow
Sabapathy Ganeshan, BSc *Ceyl.*

School of Mechanical and Manufacturing Engineering

Incorporates Aerospace Engineering and Naval Architecture

Nuffield Professor of Mechanical Engineering and Head of School
Brian Edward Milton, BE PhD *UNSW,* MSc *Birm.,* CPEng, FIEAust, FSAEA, MRAeS (31/12/1998)

Director of Research
Kerry Patrick Byrne, BE MEngSc *Qld.,* BSc *Melb.,* PhD *Siton.*

Director of Laboratories
Graham Lindsay Morrison, BE PhD *Melb.,* FIEAust, CPEng

Executive Assistant to Head of School
Eleonora Maria Kopalinsky, BE PhD *UNSW (31/12/98)*

Director of Undergraduate Studies
Robin Arthur Julian Ford, BScEng PhD *Lond.,* CPEng, ACGI, MIEAust

Director of Graduate Studies
Masud Behnia, BSME, MSME PhD *Purdue,* PE, CPEng, MASME, MAIAA, FIEAust

Undergraduate Admissions, Advanced Standing Officer
Chakravarti Varadachar Madhusudana, BE *Mys.,* ME *I.I.Sc.,* PhD *Monash,* CPEng, MIEAust, MASME

Aerospace Engineering Course Co-ordinator
John Randall Page, BSc *Hart.,* MSc *Cran I.T.,* CPEng, FBIS, MRAeS, MAIAA

Manufacturing Engineering and Management Course Co-ordinator
Hartmut Kaebernick, Dipl-Ing Dr-Ing *T.U. Berlin,* CPEng, FIEAust, SMSME, VDI

Mechanical Engineering Course Co-ordinator
Professor Eric Joseph Hahn, BE BSc PhD *UNSW,* CPEng, FIEAust, MASME

Mechatronic Engineering Course Co-ordinator
Richard Adrian Willgoss, BSc PhD *Siton.,* CPEng, MIEE, MIEEE, FIEAust, FWTIA

Naval Architecture Course Co-ordinator
Lawrence Julian Doctors, BE MEngSc *Syd.,* PhD *Mich.,* CPEng, FRINA, MSNAME, FIEAust

Professors
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EJ Hahn
H Kaebernick
GL Morrison
Clifford Patterson, MA PhD *Camb.*, FIEAust, CPEng, FIMechE, CPhys, FinstP, FIMA, MIEE

Associate Professors
John Edward Baker, MSc *Syd.*, BE MEngSc PhD *UNSW*
M Behnia
LJ Doctors
RAJ Ford
Richard Butler Frost, BE *UNSW*, CPEng, FIEAust, FRSA
Khoi Hoang, BE *Phutho Saigon*, PhD *UNSW*
Donald Wainwright Kelly, BE *Syd.*, PhD *Lond.*
Roger Malcolm Kerr, BSc *Lond.*, MSc *Bath.*, DPhil *Oxf.*
Eddie Leonardi, BScEng PhD *UNSW*, CPEng, MASME, MIEAust, MASHRAE
Robert Bond Randall, BTech *Adel.*, BA *Melb.*, CPEng, MIEAust, MAAS

Senior Lecturers
Noor-e-Alam Ahmed; BSc *Strath.*, PhD *Cran I.T.*, CPEng, MIMechE
Anthony John Barratt, BE *N.S.W.I.T.*
John Michael Challen, BE MEngSc *Syd.*, PhD *UNSW*, MIEAust
Ka Ching Chan, MASc *Tor.*, PhD *UNSW*, CPEng, MIEAust
Mahiuddin Chowdhury, BScEng *Bangl.U.E.T.*, PhD *Nicle. (U.K.)*, Eur Ing, FRINA, MIEAust
Leonard Edward Farmer, BE MEngSc PhD *UNSW*, CPEng, MIEAust
Phillip John Helmore, BE MEngSc *UNSW*, CPEng, MIEAust, MSNAME
Atiye Berman Kayis, BSc MS *M.E.T.U.*, PhD *Istanbul T.U.*
See Seng Leong, BE PhD *UNSW*, CPEng, MIEAust
Ian Lachlan Maclaine-cross, BE *Melb.*, PhD Monash, MIEAust
CV Madhusudana
Philip Mathew, BE PhD *UNSW*, CPEng, MIEAust
JR Page
Robin Arthur Platfoot, BE *UNSW*, PhD *Syd.*
Hugh Lithgow Stark[1], BSc PhD *Strath.*, CPEng, FIMechE, MIEAust, RPEQ
Richard Adrian Willgoss
Khosrow Zarrabi, MSc PhD *UMIST*, MIEAust
[1] *50% appointment*

Lecturers
Robert Thomas Casey[2], BE MESc PhD Qld.
Jayantha Katupitiya, BScEng *Sri Lanka*, PhD *Leuven*, MASME, MIEEE, MIEE
Michal John Tordon, DipIng *Bratislava*, PhD *Prague*, MIEEE
Zoran Vulovic, DipIng *Belgrade*, MSc *Cran I.T.*
[2] *25% appointment*

Associate Lecturer
Maruf Hasan, BScEng *Bidesh Engin.*, MEng *Asian I.T.*, CPEng, MIEAust

Honorary Visiting Professors
Alexander Eric Churches, BE PhD *UNSW*, ASTC, FIEAust, CPEng, FRSA
Peter Louis Brennan Oxley, BSc PhD *Leeds*, CPEng, CEng, FTSE, FIEAAust, FIMechE

Emeritus Professor
Graham de Vahl Davis, AM, BE *Syd.*, PhD *Camb.*, CPEng, FIMechE, FIEAust, MASME, FTSE

Honorary Associate
Dr CH Warman

Honorary Visiting Fellows
Peter Yo Pin Chen, BSc MEngSc ME PhD *UNSW*, ASTC
Prabhat Kumar Pal, BME *N.C.E. Bengal*, BTech PhD *I.I.T. Kharagpur*, CPEng, FRINA, FIEAust, MIINA, MSTG Hamburg

Administrative Officer
Vacant

Administrative Assistant (School Offfice)
Guilia Pearson

Professional Officers
James Beck, ME *Prague*
Anthony Gordon Harris, BSc *Exe.*
Alfred Win Lin Hu, BE *Rangoon I.T.*, MIEEE
Yefim Kotlyar, BMechEng *Moscow Mech. Inst.*
Philip Chi Bong Kwok, BE *BeijingInst.Aer.& Astro.*, CPEng, MIEAust, MIEEE
Alexander Lev Litvak, DipIng *Odessa*, MEngSc *UNSW*, CPEng, MIEAust
Jason Trihung Nhieu, BSc *Cheng Kung Nat.*, MEngSc *UNSW*, CPEng, MIEAust
Russell Norman Overhall, BE *UNSW*, CPEng, MIEAust
Charles James Sanderson, BE *Syd.*, MScEng *UNSW*

Computer Systems Officer
David Alexander Herd, BSc *Syd.*

School of Mining Engineering

Professor of Mining Engineering and Head of School
James Maurice Galvin, BSc BE *Syd.*, PhD *Wits*, CPEng, FAusIMM, FIEA, FIEAust, MISRM

Kenneth Finlay Chair of Rock Mechanics Professor
Bruce Kenneth Hebblewhite, BE *UNSW*, PhD *N'cle.(U.K.)*, DipAICD *N.E.*, MAusIMM, MAIME, MISRM

Emeritus Professor of Mining Engineering
Frank Ferdinand Roxborourgh, BSc PhD *Durh.*, CPEng, CEng, FIEAust, FIMM, FAusIMM, FIMINE

Associate Professor
David Clement Laurence BSc BE ME *Syd.*, MBA *UNE*, MAusIMM

Adjunct Associate Professor
Roy Moreby BSc PhD, *Camborne*, FMVSSA.

Senior Lecturers
Duncan Ronald Chalmers, BE *UNSW* ME(Hons), *UOW*, GradDip *ITATE*, FIQ
Paul Carter Hagan, BE PhD *UNSW*, MAusIMM
John Ormiston Watson, BScEng *Nott.*, PhD *S'ton.*

Lecturers
Christopher Raymond Daly, BE MSc PhD
GradDip(Higher Ed) *UNSW*, GradDip(Min Ecs), *Macq.* MAIME, MAusIMM

Senior Research Fellows
Yuejun Cai, BE PhD *CSUT*, MSc *UQ*
John Christopher William Fowler BSc *Manch*, PhD *UNSW*, CEng, MICE, MIExpE

Research Fellows
Ben Bin Lin BE ME *CSUT*, PhD *UNSW*, MAusIMM, MISRM

Visiting Fellows
Amal Krishna Bhattacharyya, BSc *Glas.*, MSc *Durh.*, PhD *N'cle.(U.K.)*, CEng, MAmIME, FIMINE, FAusIMM, MCIMM, PEng
Stephen Geoffrey Gemell, BE *Syd.*, FAusIMM, AIMMPE
Edmund James Malone, MSc *Syd.*, MBA *Macq.*, FAusIMM, FAIM, MGSA
Anthony Charles Partridge, BSc *Leeds*, MSc PhD *McG.*, CEng, MIMM
Gour Chand Sen, MSc *Wales*, PhD *Durh.*, CEng, FIMINE, FAusIMM, Hon FexpE.
Venkata Satyanarayana Vutukuri, BScEng *Ban.*, MS *Wisconsin.*, PhD *Tech.Sc Poland*, MAIME

Director of Development
James Close, BE *UNSW*

Administrative Assistant
Carol Vallance

School of Petroleum Engineering

Director
Wolf Val Pinczewski, BE Nicle(N.S.W.), PhD *UNSW*, CPEng, *MIChemE*

Associate Professor
Sheikh Rahman, BSc *Chitt.*, MSc *Strath.*, PhD *Clausthal*

Senior Lecturer
Henry Alfred Salisch, BSc *Quito Poly. Inst.*, MSc *Oklahoma*, MS *Venezuela Central*

Lecturer
Patrick Wong, BE ME PhD UNSW

Visiting Fellow
Ferda Akgun, BSc *Ankara*, MSc *U.S.L.*, PhD *C.S.M.*

Visiting Lecturers
Guy Allinson, BSc *Leeds*, DipSocSci *Birm.*
Barry Walsh, BE PhD *Syd.*
Wayne Davies, BSc(ChE)PhD *Syd.*, MIE(Aust).

Professional Officer
Juan Carlos Zajaczkowski, BE *Buenos Aires*

Administrative Assistant
Jennifer Ruth Lippiatt

Secretary
Rachel Goldberg

Energy Research Development and Information Centre (ERDIC)

Director
Vacant

Graduate School of Biomedical Engineering

Associate Professor and Head of School
Bruce Kenneth Milthorpe, BA *Macq.*, PhD *A.N.U.*

Professor of Biomedical Engineering
Klaus Schindhelm, BE PhD *UNSW*, FIEAust., CPEng (Biomed)

Adjunct Professor
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Associate Professors
Alberto Pompeo Avolio, BE PhD *UNSW*
Christopher David Bertram, MA DPhil *Oxf.* FIEAust.

Adjunct Associate Professor
John Campbell Woodard, BE MSc PhD *UNSW*, MIEEE, MASAIO

Visiting Professors
Peter Craig Farrell, BE *Syd.*, SM *M.I.T.*, PhD *Wash.*, DSc *UNSW*, MASAIO
Barry Stuart Gow, BDS MDS PhD *Syd.*

Senior Lecturer
Nigel Hamilton Lovell, BE PhD *UNSW*, MIEAust, MIEEE

Adjunct Senior Lecturer
William Robert Walsh, BA (Chem.) BA (Biol.) *Bucknell*, PhD *Rutgers*

Lecturers
Ross Alexander Odell, BSE *Prin.*, PhD *M.I.T.*
Laura Anne Poole-Warren, BSc PhD *UNSW*

Professional Officer
Peter Roman Slowiaczek, BSc *Nicle(N.S.W.)*

Administrative Officer
Sacha Maurice Sadler

Visiting Fellow
Andrew John Ruys, BE PhD *UNSW*

Graduate Programs in Business and Technology

Director and Adjunct Professor
John Toohey, BSocWk *Qld.*, MSW *Carle.*, PhD *Macq.*

Deputy Director and Adjunct Associate Professor
Michael MCGuirk, MAppSc *Melb.*, MBA *Macq.*

Co-ordinator MBT Program
Margaret Brennan

Co-ordinator – Quality and Resources
Vacant

Student Liaison Officer MCom Program
Kass Finlay, BA *Cant.*, BMus *VUW.*, DipTchng., DipBusStud (Training & Development) Massey

Student Liaison Officer MTM Program and Assistant to the Director
Agnes Heah, BBus *RMIT*, DipMgmt *MIM*

Student Liaison Officer MTM Program
Rebecca Kimber

Administrative Assistant
Vacant

Centre for Advanced Numerical Computation in Engineering and Science

(in association with the Faculty of Science and Technology)

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

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Yaping Shao, DipMet *Bonn*, PhD *Flin.*

Administrative Assistants
Karen Hahn
Jenny Hartley

Centre for Remote Sensing and Geographic Information Systems

(in association with the Faculty of Science and Technology)

Director
Richard Lucas (School of Geography), PhD *Bristol*

UNSW Groundwater Centre

(in association with the Faculty of Science and Technology)

Director
Dr RI Acworth, BSc *Leeds*, MSc PhD *Birmingham*

Senior Lecturer
Dr J Jankowski, MSc PhD *Wroc.*

Handbook User Guide

This handbook is divided into separate sections for each School/Unit, identified by a four-letter code (e.g. CENV, School of Civil and Environmental 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 Engineering and Management (MANF) and Naval Architecture (NAVL) these subjects are also included with the School.

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, Honours, Professional Practice, Course Transfers and a number of other details with which you should be familiar.

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 coursework 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 pleased 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
X2	winter 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	Life Sciences
BIOT	Department of Biotechnology	Life Sciences
CEIC	School of Chemical Engineering & Industrial Chemistry	Engineering
CHEM	School of Chemistry	Science and Technology
CHEN	Department of Chemical Engineering	Engineering
CENV	School of Civil and Environmental Engineering	Engineering
COMP	School of Computer Science & Engineering	Engineering
ECOH	Department of Economic History	Commerce & Economics
ECON	School of Economics, Departments of Econometrics and Economics	Commerce & Economics

Prefix	Organisational Unit	Faculty/Board
ELEC	School of Electrical Engineering and Telecommunications	Engineering
FINS	School of Banking and Finance	Commerce & Economics
FUEL	School of Chemical Engineering and Industrial Chemistry	Engineering
GEOG	School of Geography	Science and Technology
GEOL	School of Geology	Science and Technology
GMAT	School of Geomatic Engineering	Engineering
GBAT	Graduate Prrograms in Business and Technology	Engineering
INDC	School of Chemical Engineering and Industrial Chemistry	Engineering
INFS	School of Information Systems	Commerce & Economics
IROB	School of Industrial Relations & Organisational Behaviour	Commerce & Economics
LAWS	School of Law	Law
LEGT	Department of Legal Studies and Taxation	Commerce and Economics
LIBS	School of Information, Library & Archive Studies	Professional Studies
MANF	School of Mechanical & Manufacturing Engineering	Engineering
MARK	School of Marketing	Commerce & Economics
MATH	School of Mathematics	Science and Technology
MATS	School of Materials Science & Engineering	Science and Technology
MECH	School of Mechanical & Manufacturing Engineering	Engineering
MINE	School of Mining Engineering	Engineering
NAVL	School of Mechanical and Manufacturing Engineering	Engineering
PETRL	School of Petroleum Engineering	Engineering
PHPH	School of Physiology and Pharmacology	Medicine
PHYS	School of Physics	Science and Technology
PLAN	School of Town Planning	Architecture
POLS	School of Political Science	Arts & Social Sciences
POLY	Department of Polymer Science	Engineering
SAFE	Department of Safety Science	Science and Technology
SENG	School of Computer Science & Engineering	Engineering

Faculty Information

Some People Who Can Help You

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

Faculty of Engineering, Dean's Office
Ms Donna Bailey, Room 508 ,Geography and Surveying Building. Tel. (02) 9385 6437

School of Chemical Engineering and Industrial Chemistry
Ms V Brennan, Room 316, Applied Science Building. Tel. (02) 9385 4318

School of Civil and Environmental Engineering
Ms K Irvine, Room 406, Civil Engineering Building, Tel. (02) 9385 5061

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

School of Electrical Engineering and Telecommunications
Dr T Hesketh, G6, or L Saifaloi, School Office, Electrical Engineering Building.

School of Geomatic Engineering
Mr L Daras, School Office, Room 529, Geography and Geomatic Engineering Building.

School of Mechanical and Manufacturing Engineering
A/Prof EM Kopalinsky, Room 105, Mechanical and Manufacturing Engineering Building.

School of Mining Engineering
Dr C Daly, Room 37,Old Main Building

School of Petroleum Engineering
Ms J Lippiatt, Room 115, Petroleum Engineering Building, Tel. (02) 9385 4144

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

Graduate Programs in Business and Technology
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 University Admission Index (UAI) obtained in the New South Wales Higher School Certificate (NSW HSC). Other students are admitted on the basis of their previous academic work. In addition, students are expected to have reached the following standards in the NSW HSC subjects or an equivalent standard:

Course Prerequisites

Mathematics
2u (60–100) or
2u and 3u (100–150) or
3u and 4u (100–200)

Some First year subjects have subject pre-requisites in addition to the over all course pre-requisites

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 in the UAC Guide.

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.

Additional subject prerequisites for Civil, Computer, Environmental and Mechanical and Manufacturing Engineering
Mathematics
2u (90–100)

and

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

and

Science
2u Physics (57–100) or
2u Chemistry (60–100) or
3u (90–150) or
4u (1–200)

Additional subject prerequisites for Electrical Engineering
Mathematics
2u (90–100)

and

English
2u Contemporary (60–100) or
2uG (60–100) or
2u (53–100) or
3u (1–50)

and

Science
2u Physics (65–100) or
2u Chemistry (65–100) or
3u (90–150) or
4u (1–200)

Additional subject prerequisites for Geomatic Engineering
Mathematics
2u (90–100)

and

English
2u Contemporary (60–100) or
2uG (53–100) or
2u (49–100) or
3u (150)

Additional subject prerequisites for Software Engineering
Mathematics
2u (90–100)

and

English
2u Contemporary (60–100) or
2uG (60–100) or
2u (53–100) or
3u (1–50)

Additional subject prerequisites for Chemical Engineering and Industrial Chemistry, Mining Engineering and Petroleum Engineering
Mathematics
2u (90–100)

and

Science
2u Physics (65–100) or
2u Chemistry (65–100) or
3u (90–150) or
4u (1–200)

Credit Points

From 1996, UNSW introduced a university wide credit point system for all subjects offered to both undergraduate and postgraduate students. Credit points are intended to provide a guide for students to the total time committment required to satisfy requirements in the subject. The system means that a subject will have the same credit point value irrespective of which faculty's course it is counting towards. Students are able to determine the value of subjects taken from other faculties when planning their programs of study. The student load for a subject is calculated by dividing the credit point value of a subject by the total credit points required for the program for that year of the course. Student load is used to determine both HECS and overseas student fees. Students who take more than the standard load for that year of a course will pay more HECS.

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 School office for clarification before making 1999 subject selections based on the credit points shown in this handbook.

Enrolment Procedures

All students re-enrolling in 1999 or enrolling in graduate courses should obtain a copy of the free leaflet Re-Enrolling 1998 available from School offices and the Student Centre. This leaflet provides detailed information on enrolment procedures and fees, enrolment timetables, enrolment in non-award 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 December 1998. 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. Course leave 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.

UNSW 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 and Technology, Engineering,and the Built Environment.

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 year and advanced skills for final year and postgraduate students.

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

Equal Opportunity in Education Policy Statement

Under the Federal Racial Discrimination Act (1975), Sex Discrimination Act (1984), and 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 age, disability, homosexuality (male or female), marital status, pregnancy, race (including colour, nationality, descent, ethnic, ethno-religious or national origin, and immigration), religious or political affiliation, views or beliefs, sex, and transgender or transsexuality. 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/ hismaximum 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 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 IAESTE, c/ -The Graduate Careers Council of Australia.

Students With Disabilities

The University of New South Wales 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 Equity and Diversity Unit, the Library and the Studentsí Guild.

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 the Equity and Diversity Unit, 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 Equity and Diversity 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:

Equity and Diversity Unit; Student Guild Advocacy Service; Student Counselling; 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 will not be disadvantaged or victimised because they have, in good faith, sought to assert their rights.

Special Government Policies

The NSW Health Department and the NSW Department of Education and Training have special requirements and policies of which students of health-related and education courses should be aware. The requirements relate to:

- clinical/internship placements which must be undertaken as part of your course *and*
- procedures for employment after you have completed the course

Health-related courses

Criminal record checks

The NSW Health Department has a policy that all students undertaking clinical placements, undergo a criminal record check prior to employment or placement in any capacity in the NSW Health System. This check will be conducted by the NSW Police Service and will be co-ordinated by the Department of Health.

Infectious diseases

Students required to complete clinical training in the NSW hospital system will be subject to various guidelines and procedures laid down for health workers by the NSW Department of Health relating to vaccination and infection control.

An information sheet is available from your course officer and further details can be obtained from your Course Authority.

Education courses

Criminal record checks

It is a requirement that a check of police records be conducted for all teacher education students applying for an unsupervised internship placement in a New South Wales Government school.

Contact your course co-ordinator for further details.

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 monthly 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 experience guidance.

For more information and membership application forms, write to The Institution of Engineers, Australia, Sydney Division, 1st Floor, 118 Alfred Street, Milsons Point 2061, Tel 9929 8544

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.

3. 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 APESMA, Level 1, 491 Kent Street, Sydney 2000, Telephone 9264 9500.

Student Clubs and Societies

Students have the opportunity of joining a wide range of clubs and societies. Many of these are affiliated with the Studentsí Guild. 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 Studentsí Guild 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 various Undergraduate Societies promote the interests of students within the Faculty of Engineering:

- Chemical Engineering Undergraduate Society (CEUS)
- Chemical Technology Society (CTS)
- Civil and Environmental Engineering Society (CEVSOC)
- Computing Science Society (COMPSOC)
- Electrical Engineering Society (ELSOC)
- Geomatic Engineering Society (GSOC)
- Mechanical Engineering Society (MECHSOC)
- The Mining Engineering Society
- Society for Petroleum Engineering (SPE)

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

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 introduce 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 also need to consult the University Calendar.

Undergraduate Study
Summary of Courses

Full-time Courses

The Faculty of Engineering offers the following full-time undergraduate courses:

Bachelor of Engineering
BE

in:	
Aerospace Engineering	3610
Chemical Engineering	3040
Civil Engineering	3620
Computer Engineering	3645
Electrical Engineering	3640
Environmental Engineering	3625
Geomatic Engineering	3741
Manufacturing Engineering and Management	3663
Mechanical Engineering	3680
Mechatronic Engineering	3685
Mining Engineering	3140
Naval Architecture	3700
Petroleum Engineering	3045
Software Engineering	3648

Bachelor of Science
BSc

Industrial Chemistry	3100

These full-time courses are designed to be taken over a period of four years.

Bachelor of Science (Technology)
BSc(Tech)

Chemical Engineering	3050
Industrial Chemistry	3110

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
Environmental Engineering	3626
Manufacturing Engineering and 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
Civil Engineering	3621
Electrical Engineering	3720
Environmental Engineering	3626
Geomatic Engineering	3747
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
Environmental Engineering	4777

Bachelor of Engineering Bachelor of Engineering
BE BE

(5 years duration) in:

Civil Engineering and Mining Engineering	3146
Chemical Engineering and Petroleum Engineering	3046

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
Chemical Engineering	3048

Other Engineering Courses at UNSW

UNSW offers other Engineering courses in specialised areas:

Course 3055: Bachelor of Engineering(BE) in Bioprocess Engineering is offered by the Department of Biotechnology. Details are found in the Handbook of the Faculty of Life Sciences.

Course 3025: Bachelor of Engineering(BE) in Ceramic Engineering

Course 3125: Bachelor of Metallurgical Engineering (BMetE)

Course 3615: Bachelor of Materials Engineering(BMatE)

These three courses are offered by the School of Materials Science and Engineering. Details are found in the Handbook of the Faculty of Science and Technology.

Co-op Program

The Universityís Co-op Program in the Faculty of Engineering consists of industry-linked, five-year courses in Aerospace Engineering, Chemical Engineering and Industrial Chemistry, Civil Engineering, Electrical Engineering, Environmental Engineering, Manufacturing Engineering and Management, Mechanical Engineering, Mechatronic Engineering, Mining Engineering, Petroleum 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 are also considered.

Further information is available from the Universityís Office of Industry-Linked Education, telephone (02) 9385 5116.

Transfer Courses

Students transferring to the University of New South Wales after successful completion of part 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 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 significant differences in the various Year 1 programs, students are not necessarily granted complete exemption from Year 1 of the course to which the transfer is made.

Enrolment quotas apply toundergraduate courses and 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.)

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. These are set out in detail in the UNSW Calendar-Summary Volume. In particular they allow for students enrolled for the first time in the first year of an undergraduate course to be advised that their academic progress is unsatisfactory if they do not pass in at least half of their program, with particular emphasis on science subjects.

Students will also be requested to show cause why they should be:

- allowed to repeat a subject that has been failed more than once. In Engineering, exclusion from a subject most often implies exclusion from the entire course.
- allowed to continue in the course if the School judges their academic record to be unsatisfactory.

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 Schools.

- 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.

4. Only in exceptional circumstances will students be allowed to enrol in a program containing subjects from more than two consecutive years of the course or totalling more than 28 hours of class contact per week for a full-time student or 14 hours of class contact per week for a part-time student. Students repeating subjects will be expected to choose a program that includes previously failed subjects and limits their weekly hours of class contact. Details of these limits are available from School offices and may only be exceeded with the express permission of the Head of School. A failed elective may be replaced by another elective.

5. Notwithstanding the above, before students can enrol in any non-standard programs, 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 are not normally included in the program for a particular year.

Honours

In the Bachelor of Engineering degree 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 and Social Sciences 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 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.

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 and Environmental 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 studentís 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 studentsí 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 acquirè, 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 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 studentís 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 2 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.

Conditions for the Award of the Degree of Bachelor of Science

The courses leading to the award of the degree of Bachelor of Science are progammed over four years of full-time study. The normal programs may be varied by the Head of the School in which the student is enrolled. The regulations governing the award of these degrees are as follows:

1. A candidate for the award of the degree of Bachelor of Science 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 or similar training for such periods as are prescribed.

2. A student may be granted advanced standing by the Professorial Board on the recommendation of Faculty, but in each case must complete the appropriate period of approved industrial training before being eligible for the award of the degree.

3. The degree shall be awarded at Pass or Honours levels. Honours may be awarded in the following categories: Honours Class I; Honours Class II, Division I; Honours Class II, Division II.

4. Students shall be required to conform with the general rules relating to University courses.

Conditions for the Award of the Degree of Bachelor of Science (Technology) or Bachelor of Science (Engineering)

The courses leading to the award of the degree of Bachelor of Science (Technology) or Bachelor of Science (Engineering) are normally programmed over six years of part-time study in the University whilst the student is employed in industry. The normal programs may be varied by the Head of the School in which the student is enrolled. The regulations governing the award of these degrees are as follows:

1. A candidate for the award of the degree of BSc(Tech) or BSc(Eng) shall:

(1) comply with the requirements for admission;

(2) follow the prescribed course of study in the appropriate school and pass the necessary examinations;

(3) complete an approved program of industrial or similar training for such periods as are prescribed.

2. A student may be granted advanced standing by the Professorial Board on the recommendation of Faculty.

3. The degree of BSc(Tech) and BSc(Eng) shall be awarded at Pass level only but in the case of superior performance throughout the course the degree shall be conferred 'with merit'.

4. Students shall be required to conform with the general rules relating to University courses.

Graduate Study
Summary of Courses

The Faculty awards higher degrees as follows: Research – Doctor of Philosophy, Master of Engineering and Master of Science; Coursework Masters ñ 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 Programs in Business and Technology within the Faculty of Engineering is responsible for the MBT Program offering the Master of Business and Technology and the Graduate Diploma in Industrial Management as well as the Master of Technology Management (see Graduate Programs in Business and Technology section in this Handbook).

Conditions governing the award of higher degrees and graduate diplomas are set out later in this handbook in Conditions for the Award of Degrees. 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) overall band 6.0

3. Combined Universities Language Test (CULT) 65%

4. Indonesia-Australia Language Foundation (IALF)* Cat 1 or 2.

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
Chemical Engineering	1010
Civil and Environmental Engineering	1630
Computer Science and Engineering	1650
Electrical Engineering	1640
Geomatic Engineering	1681
Industrial Chemistry	1016
Mechanical and Manufacturing Engineering	1662
Mineral Processing and Extractive Metallurgy	1046
Mining Engineering	1050
Petroleum Engineering	1017
ME	
Biomedical Engineering	2675
Chemical Engineering	2150
Civil and Environmental Engineering	2650
Computer Science and Engineering	2665
Electrical Engineering	2660
Geomatic Engineering	2721
Mechanical and Manufacturing Engineering	2692
Mining Engineering	2060
Petroleum Engineering	2156
MSc	
Biomedical Engineering	2795
Chemical Engineering	2010
Civil and Environmental Engineering	2750

Computer Science and Engineering	2765
Electrical Engineering	2760
Industrial Chemistry	2016
Mineral Processing and Extractive Metallurgy	2046
Mining Engineering	2060

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 appointments in government and industrial research and development laboratories and in higher education. 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 Bachelorís 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.

Coursework Masters Degrees

Course work programs: Detailed information on coursework 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 coursework 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
Construction Management	8612
Electrical Engineering	8501
Engineering Construction and Management	8612
Geotechnical Engineering	8612
Geomatic Engineering	8652
Land Administration	8653
Manufacturing Engineering	8531
Mechanical Engineering	8541
Mining and Mineral Engineering	8055
Process Engineering	8016
Project Management	8612
Remote Sensing	8641
Structural Engineering	8612
Transport Engineering	8612
Water Engineering	8612
Water and Wastewater Treatment	8612
Waste Management	8612
MEnvEngSc	
Civil and Environmental 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	
Manufacturing Management	8531
Engineering Construction and Management	8617
Project Management	8617
Construction Management	8617
Waste Management	8617
Water and Wastewater Treatment	8616
MEnvEngSc	
Civil and Environmental Engineering	8618
MBT	
Business and Technology	8616

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 project work. 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 1996 are required to complete a program totalling a minumum of 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.

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.

From 1997 all coursework Masters programs are fee-paying. A schedule of fees is available on enquiry.

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 90 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 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.

From 1997 all Graduate Diploma courses offered by the Faculty of Engineering are fee paying. A schedule of fees is available on enquiry.

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

Internal Mode Delivery

Biomedical Engineering	5445
Civil and Environmental Engineering	5459
Computer Science	5452
Electrical Engineering	5458
Electric Power Engineering	5435
Geomatic Engineering	5492
Manufacturing Management	5457
Information Science	5453
Industrial Engineering	5455
Land Administration	5493
Mechanical Engineering	5456
Mining and Mineral Engineering	5040
Petroleum Engineering	8031
Remote Sensing	5496

External Mode Delivery

Engineering Construction and Management	5454
Waste Management	5454
Water and Wastewater Treatment	5454
Project Management	5454
Construction Management	5454
Mining Management	5057

Further details of the recommended programs of study may be obtained from the relevant schools.

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

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 and limbs
Biomedical instrumentation and computer acquisition
Biomedical polymers and acrylic cements
Bioprostheses
Blood pressure and heart rate variability
Cardiovascular effects of body movement
Cell separation technologies
Computer-aided histological analysis
Connective tissue healing
Cytometry
Endothelial cell/biomaterial interactions
Extracorporeal therapies

Flow in collapsible tubes
Flow visualisation and measurement
Image analysis of cells
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

Chemical Engineering and Industrial Chemistry

Industrial Chemistry

Chemical reaction engineering, catalysis and synthetic fuel production and processing; petrochemistry; conversion processes of coal to oil; catalytic methods and reactors; catalytic methods for air pollution control; kinetic modelling of catalytic processes; catalyst activation and de-activation studies; car exhaust catalysts

Solid state, molten salt and aqueous electrochemistry; electrochemistry of glass and chemistry of glass melting; physical and chemical characterisation of glasses

Metal electrowining; battery research, vanadium redox cell development. Electrode kinetics and mechanistic studies. Aluminium electrolysis; electrolytic decomposition of organochlorines. Conducting polymer electrodes evaluation and development of solid state gas sensors

Environmental chemistry; Analysis of industrial pollutants; air and water pollution monitoring; chemical strategies for emission control; occupational health chemistry; development of new analytical methods for process control and environmental monitoring; environmental catalysis; air pollution control

Polymer Science

Preparative and analytical polymer chemistry
Membrane preparation and properties
Polybutadiene polymerisation by Ziegler-Natta catalysts, molecular weight properties
Elastomer filler applications in rubber and plastics
Thermal analysis of elastomer and plastics
Interpenetrating polymer networks, fracture toughness of polymercomposites and thermoplastics
Conducting polymers; polymer fractals; radiation grafting and crosslinking, conducting polymer membranes
Structure-Property relationships of optical polymers
Free-radical polymerisation kinetics
Hydrogels and Biomaterials
Rigid-rigid polymer blends
Conducting polymer composites
Rheology of polymeric systems

Chemical Engineering

Particle dynamics; fluidisation and spouted bed processes drying, carbonisation, devolatisation and gasification; sedimentation and thickening; filtration mechanisms, dewatering of filter cakes; characterisation of particulate materials; particle coating; preparation of novel photocatalysts; aggregation kinetic modelling; electrostatic charge determination; Non-Newtonian fluid-particle systems

Reaction engineering, mass transfer with chemical reaction in heterogeneous systems; effect of mixing and nonideal transport; complex consecutive reactions, catalytic reaction engineering, pressure reactors; mathematical modelling. Multiphase photocatalytic reactors. Catalytic distillation processes

Membrane processes
Membrane fabrication for ultrafiltration and reverse osmosis; membrane characterisation; ultrafiltration of proteinaceous solutions; desalination of brackish water; ion separation; pervaporation, membrane distillation; gas fractionation, cross flow filtration; liquid membranes; membrane bioreactors; environmental applications; dynamic membranes; ceramic membranes; hydrogel coatings

Pollution studies
Unit operations in water pollution control, biological treatment methods, advance treatment methods; unit operations in air pollution control; bio-filtration, odour control processes; fabric filtration monitoring; hot gas cleaning

Process design and control
Computer aided design; systems analysis and process identification; plant simulation; strategies for fault analysis; process optimisation studies

Separations science
Development and evaluation of new methods for solid-liquid, liquid-liquid and gas-gas separations
Energy conservation and waste minimisation; improved design procedures for heat exchange networks; mass exchange networks for waste minimisation

Mineral Processing
Hydrometallurgy; minerals dissolution and leaching processes; liquor purification processes, metal recovery by precipitation, adsorption, ion-exchange, cementation and electrolytic processes, dewatering of minerals

Heat Transfer
Refrigeration, heat transfer and food engineering; neural networks; genetic algorithms and other optimisation methods; computational fluid dynamics; phase change and inverse heat transfer; food refrigeration. Heat exchanger failing.

Supercritical Fluid Technology
Fundamental studies and novel applications in the pharmaceutical environmental and natural product industries

Fuel technology fuel science and engineering

Fuel processing; chemical and physical properties of chars; pyrolysis of coal and composition of the volatile products; fluidised bed gasification; thermochemistry of gas-solid reactions in fluidised beds; thermogravimetric analysis of chars; kinetics of carbon gasification; lubricating oil and bitumen from oil shale. Combustion; fluidised bed combustion; flames, burners and flame stability; oil-coal suspensions; incinerator design for gaseous liquid and solid wastes; industrial applications of natural gas; furnace modelling; High efficiency natural gas burners; low emission gas burners. Fuel efficiency; studies on fuel efficiency systems; energy and resource recovery from wastes; efficiency of fuel conversion processes
Fuel constitution; analysis, constitution and characterisation of primary and derived fuels

Air pollution; workplace atmospheres; combustion generated pollutants gaseous and particulate
Solid wastes; pyrolysis of waste material; resource recovery; energy analysis; incineration

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 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

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 and Wastewater Treatment
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

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 Management Mr 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

Active vision
Advanced database systems
Algorithm animation
Application of logic programming
Architectural support for languages and operating systems
Artificial intelligence
Automatic index generation
Belief revision
Cognitive and situated robotics
Cognitive engineering
Cognitive modelling
Combinatorial algorithms
Combinatorial problems and algorithms
Communication protocols
Communication systems
Compiler technology
Compilers and parsing
Computational algebra
Computational aeometry
Computer aided design
Computer architecture
Computer arithmetic
Computer assisted Learning
Computer graphics
Computer networks
Computer organisation
Computer security
Computer vision
Computer vision and control for robotics
Computers and Biology
Connectionist modelling of human analogical reasoning & relational cognition
Cooperative information systems
Data mining
Data modelling
Database implemention & performance modelling
Database in web environment
Database management
Database systems
Dataflow computing
Decision making under uncertainty
Decision support systems
Deductive databases
Diagrammatic reasoning
Distributed applications
Distributed computing
Distributed database
Distributed operating System
Distributed simulation
Electronic commerce
Expert systems
Fault diagnosis & reliability of digital systems
Fault tolerant computer systems
Formal methods
Formal methods of Reasoning
Formal specifications
Functional programming
Fuzzy databases
Fuzzy systems and evidence theory
Graph-theoretic algorithms
Heterogeneous computing
Human computer interaction
Image mensurational modelling
Image processing
Information retrieval
Information retrieval/filtering
Information processing

Intelligent agents
Intensional programming
Knowledge acquisition
Knowledge acquisition/representation
Knowledge based systems
Knowledge discovery
Knowledge engineering
Knowledge extraction from training neural networks
Knowledge representation
Languages
Learning algorithms
Learning theory
Logic programming
Logic programming systems
Logics of action
Machine Learning
Management of uncertainty and possibility theory
Microprocessor based equipment
Mobile computing
Model based reasoning
Multimedia
Multimedia systems
Multiprocessor architectures
Natural language processing
Natural language understanding
Natural language
Neural networks
Nonmonotonic reasoning
Object orientation
Object oriented databases
Object oriented design and technology
Object oriented distributed systems
Operating systems
Parallelism
Parallel and distributed computing
Parallel and distributed systems
Parallel processing
Parsing & translation
Pattern recognition
Performance specification
Philosophical foundations of AI
Plagiarism detection
Planning
Process algebras
Production systems
Program similarity
Program transformation
Programming environments
Programming language and implementation
Query language testing
Reactive systems
Real time systems
Recurrent network architectures
Reverse engineering
Robotics
Scientific computing
Signal recognition
Simulation and modelling
Software configuration
Semiconductor device simulation
Software engineering
Specification and refinement
Specification and verification of real-time concurrent systems
Theory of computation
Theory of database systems
Theory of neural networks
Temporal logic
Tensor product networks
Timed systems
Version control
Versioned software engineering
Virtual environments
Visualisation
VLSI systems
Web operating systems (WOS)
Workflow modelling

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 Utilisation

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 safety
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 advanced signal 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

On-line Measurement Systems; Systems Analysis, Identification and Control: Digital Image Processing in Measurements and Control; Computer Simulations of Power Generation and Industrial Processes, their Optimisation and Control; Computer Simulations in Education

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 satellite 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
Refrigeration and air conditioning
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 following processes: machining, electric discharge machining, laser cutting
Performance of single and multipoint cutting tools including tool life and economics 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 Artificial Intelligence 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

Mining Engineering

Subsidence of strata overlying underground coal workings and related damage effects; development of a 'Generalised Empirical Method' for subsidence prediction, enabling the empirical data from one coalfield to be employed for predictions elsewhere, after appropriate modifications through the use of a parameter reflecting the lithological character of the undermined strata; comparison of the efficiencies of different ground sealing materials in containing leachates from land fill disposal of various wastes.

Application of computing to mining engineering, operations research and computer simulation of processes; mine safety including lighting, ergonomics in mining, vibration and jarring of machine operators; general occupational health and safety; attitudes to safety; windblasts in underground coal mines due to roof falls.

Improving safety and strata control in coal mining, including both field performance of local mine designs to establish mechanisms of behaviour and development of the theoretical knowledge base to address these mechanisms in design; avoidance of sudden uncontrolled collapses of strata in underground coal mines; minimising the hazards from windblasts in coal mines arising from the ìpiston effectî of massive strata collapses; use of electrostatically charged water sprays to suppress respirable dust at the coal face; impact breakage of rock.

Mining management, motivating and managing change in the future; management structures for a changing environment; application of TQM techniques in lieu of statutory regulation.

Instrumentation development for frictional ignition and rock cuttability testing; exploration and mining of gemstone deposits.

Minerals engineering, especially coal: residence times and kinetics in flotation; image analysis of coal sections; mathematical modelling of fluid flow in coal distributors.

Mining explosives: the effect of stemming confinement on fragmentation and movement in blasting, including investigation of the size of the stemming material on the effect of blasting efficiency and of fragmentation size and the explosive cavity for the same blasthole diameter to stemming size ratio; design and use of linear shaped charges to form radial cracks along a predetermined line; depth penetration in the target material.

Air leakage in ventilation ducting; compressive strength of mine pillars; failure criteria for rock and rock mass; role of chemical solutions in rock fracturing; role of tensioning in rock bolting.

Geomechanics: boundary element methods for the computation of stress near underground openings; boundary element methods for the prediction of crack propagation in rock, as applied in rock cutting technology, blasting technology and hydro fracturing; finite element methods for the analysis of wind blast in underground coal mines due to goaf collapse.

Petroleum Engineering

Improved Oil and Gas Recovery
Fundamental studies of physical mechanisms for multi-phase flow through porous media. Network modelling and prediction of capillary pressure, relative permeability and residual oil saturation. Effect of correlated heterogeneity on network model predictions. Constant rate injection porosimetery and measurement of heterogeneity on the pore and core scales. Scale-up from pore-scale to core and well log scales. Prediction of petrophysical properties. Gas injection processes and recovery of waterflood residual oil.

Formation Evaluation
Conventional log analysis/petrophysics and formation evaluation. Log interpretation and evaluation in sandstones and shaly sandstones

Petrophysical study in multi-mineral and lithologically complex formations. Petrophysical evaluation of limestone reservoirs.

Special log analysis, petrophysics and formation evaluation. Determination from well logs of the mineral composition and clay distribution in a reservoir. Estimation and evaluation of permeability from well logs in heterogeneous formations. Electrofacies evaluation in lithologically complex formations. Identification of lithofacies and depositional facies from well logs. Interwell prediction of petrophysical parameters in reservoirs

Application of state-of-the-art technology in Petrophysics. Application of optimisation techniques in log interpretation.

Application of neural network techniques in log analysis and formation evaluation. Application of pattern

recognition techniques in log analysis and formation evaluation. Application of the hydraulic flow units concept and theory in log analysis and petrophysical evaluations

Application of geostatistics in the spatial distribution study of petrophysical parameters.

Geological uncertainty and quantification. Statistical analysis of geological data. Determination of petrophysical properties from well logs.

Reservoir modelling using petroleum geostatistics. Pixel- and Object-based algorithms. Integrating seismic attributes, pressure tests and production data. Upscaling of high-resolution reservoir models. Geoscience applications of artificial intelligence. Expert systems,

fuzzy logic, neural networks and genetic algorithms.

Drilling Optimisation, Simulation and Equipment Design

Optimum drilling equipment design. Numerical and analytical modeling of drilling equipment and drilling wells. Estimation of equipment strengths, drilling stresses. Prediction and minimisation of drilling costs. Lightweight alloys in drilling and downhole tubular design. Drilling vibrations and elimination techniques. Slim hole drilling and stability of downhole tubular. Coiled tubing design. Penetration rate modeling. Air, foam and mist drilling and improvement techniques.

The South-East Asia region including Australia continues to grow in importance as a major oil and gas producing region. The operators realise the value of developing fields using contemporary drilling and completion techniques to create highly deviated, extended reach and multilateral wells, mono-bore wells, slim hole wells, etc. These new technologies offer economic benefits through a mix of lower development costs, higher production rate and improved recovery. A number of obstacles to the effective application of these techniques include:

Borehole instability in shales. Directional control in drilling horizontal and multilateral wells. Instability of drill pipes for deep and slim holes,

Managing incompatibilities between drilling muds and formations. Formation damage due to drilling and completion fluids. Drilling equipment and processes for high temperatures. Hydraulic fracture treatments in high stress and low permeability rocks. Disposal of drill cuttings and mud waste.

The School of Petroleum Engineering has established leading-edge research facilities to improve the understanding of processes and mechanics involved in the above areas and develop drilling and completion technologies to reduce field development costs and improve recovery efficiency. The research facilities include well equipped laboratories and computer modeling capabilities: rock and fracture mechanics laboratory; petrophysical laboratory; drilling fluid and cementing laboratory; formation damage analysis laboratory (dynamic filtration, fluid displacement, SEM, petrographic, etc.); borehole stability analysis laboratory (chemical potential, pore pressure penetration, swelling of shales, transient pressure pulse permeameter etc); torque and drag evaluation in slim-holes; design and optimisation of drilling muds and cements, stability analysis of tubulars including drill pipes and casings; design of well trajectories and completions for different in-situ stress and hole conditions and production strategies; design of hydraulic fracture stimulation programs for tight gas and geothermal reservoir(HDR) development; acid stimulation of low permeability sand stones; and design and planning of mud waste and cutting disposal in deep isolated formations by hydraulic fracturing.

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 in remote sensing and GIS

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 Chemical Engineering and Industrial Chemistry

Head of School
Professor AG Fane

Administrative Officer
Vivienne Brennan

The School provides a Bachelor of Engineering in Chemical Engineering and a Bachelor of Science in Industrial Chemistry. Both degrees are full-time four year degrees accredited by the Institute of Engineers Australia; the BE Chemical Engineering is also accredited by the Institution of Chemical Engineers (UK).

Combined degrees are also available for suitably qualified students. The BE/M.Comm. and BSc/M.Comm. allow advanced standing in the Masters of Commerce and the BE/MBiomed E allows advanced standing in the Masters of Biomedical Engineering.

The School has a vigorous postgraduate training program focused on national and international areas of importance. A postgraduate course work based Master's degree in Process Engineering (8016) is offered. Research degrees include a Master of Science in Industrial Chemistry (2016) and in Chemical Engineering (2010) and a Master of Engineering in Chemical Engineering (2150). A doctoral research program is offered in Chemical Engineering (1010) and Industrial Chemistry (1016).

Chemical engineering is the application of the principles of the physical sciences, together with the principles of economics and human relations, to fields in which matter undergoes a change in state, energy content or composition. The chemical engineer is generally responsible for the design, construction and operation of plant and equipment used in the chemical processing industries. Chemical Engineers are employed in a very wide range of industries including the Chemical, Minerals, Pharmaceutical, Food and Energy industries. Many Chemical Engineers work in environmental management, research and development business, management and computer applications.

Industrial Chemists are applied scientists, some of whom are engaged in solving problems in forefront research areas while others are responsible for the successful operations of Australias chemical industry. Industrial Chemists analyse raw materials, apply computers to the simulation and control of chemical plant and verify the quality of the product. A particularly important activity is the control and management of the environment of industrial processes. Industrial Chemists are capable of fulfilling a multiplicity of roles as research scientists, development chemists, technical representatives and as plant/company managers.

For the award of Honours in the Chemical Engineering and Industrial Chemistry degree courses, students need to have distinguished themselves in the formal work, in other assignments as directed by the Head of the School, and in the final year project, for which a thesis is required. It is compulsory that, before completion of the course, students in Chemical Engineering must obtain a minimum of twelve weeks professionally oriented or industrial experience. It is compulsory that, before graduation, students in the full-time courses in Industrial Chemistry obtain a minimum of twelve weeks professionally oriented or industrial experience. Students in the part-time courses in Industrial Chemistry must complete an approved program of industrial experience of not less than twelve months prior to the award of the degree.

Undergraduate Study

Students are expected to possess a calculator having exponential capabilities (ln x and exp x or îx to the yì); however, more advanced calculators and personal computers, will be found useful. In examinations, students may be required to use calculators supplied by the University, so that no student will have an unfair advantage over another. Further information may be obtained from the Head of the School.

Students of both Chemical Engineering and Industrial Chemistry are advised to have a copy of Perry J H ed. Chemical Engineers Handbook 6th ed. McGraw-Hill. This book is used extensively for most subjects and units. Certain subjects and units do not have specified textbooks and in these cases reference books are used or printed notes supplied.

Course Outlines

3040
Chemical Engineering - Full-time Course

Bachelor of Engineering
BE

This course extends over four years and students study full-time during the day for twenty-eight weeks of each year (excluding examination and recess periods).

Successful completion of the BE degree course is accepted by the Institution of Chemical Engineers, the Institution of Engineers, Australia, and Royal Australian Chemical Institute as sufficient academic qualification for corporate membership.

Various course patterns involving full-time or part-time study may be approved by the Director of Teaching and Learning.

With one additional year of study, it is possible, upon completion of the Petroleum Engineering program 3045, to obtain a double BE degree in Petroleum and Chemical Engineering 3046 because the first two years of the Petroleum Engineering course are identical to the first two years of the Chemical Engineering course. Combined degrees BE/M. Comm and BE/M. Biomed.E are also available (see below).

		HPW S1	HPW S2	CP
Year 1				
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
CHEN1020	Engineering 1 CE +	6	6	30
MATH1131	Mathematics 1A	6	0	15
MATH1231	Mathematics 1B	0	6	15
PHYS1002	Physics 1	6	6	30
Total HPW Session 1		**24**		
Total HPW Session 2		**24**		
Total Credit Points		**120**		
Year 2				
CEIC2020	Computing	3	0	9
CHEN2010	Material and Energy Balances	2	2	10
CHEN2020	Flow of Fluids	4	0	10
CHEN2031	Heat and Mass Transfer	0	4	10
CHEN2050	Chemical Engineering Lab. 1	0	3	7.5
CHEN2060	Introduction to Process Chemistry	6	2	20
CHEN2070	Instrumental Analysis for Chemical Engineering	2	2	10
ELEC0809	Electrical Engineering1C	2	0	6
MATH2031	Mathematics	2	3	20
MATH2899	Applied Statistics CE	0	3	7.5
General Education subject/s		2	2	15
Total HPW Session 1		**23**		
Total HPW Session 2		**21**		
Total Credit Points		**125**		
Year 3				
BIOT3100	Fermentation Process	0	2	6
CHEN3011	Engineering Thermodynamics	3	0	9
CHEN3020	Quant. Chem. Process	0	3	9
CHEN3031	Advanced Transport Phenomena	0	3	9
CHEN3041	Particle & Separation Processes	4	2	18
CHEN3064	Process Design & Economics	3	3	18
CHEN3065	Plant & Equipment Design	2	2	12
CHEN3071	Process Control	0	4	12
CHEN3080	Chemical Engineering Practice 2	2	1	9
CHEN3100	Kinetics & Chemical Reaction Engineering	2	2	12
CHEN3110	Systems Modelling & Analysis	2	0	7.5
CIVL0616	Structures	2	0	6
General Education subject/s		2	0	7.5
Total HPW Session 1		**22**		
Total HPW Session 2		**22**		
Total Credit Points		**135**		

		HPW S1	HPW S2	CP
Year 4				
SESC3310	Social Issues in Science & Technology	2	0	5
CHEN4010	Separation Processes 2	2	0	5
CHEN4020	Advanced Reaction Engineering	2	0	5
CHEN4030	Environmental Pollution Control+	2	0	5
CHEN4070	Process Dynamics & Control	3	2	12.5
CHEN4081	Design Project	3	3	18
CHEN4090	Research Project+	2	10	36
CHEN4100	Professional Electives	3	3	15
CHEN4120	Process Plant Management & Operations	3	3	18

Total HPW Session 1 22
Total HPW Session 2 21
Total Credit Points 119.5

+These subjects contribute towards satisfaction of the General Education Requirement.

***Note:** The Chemical Engineering course has been revised. The new course was implemented in years 1 and 2 in 1998, and in year 3 in 1999. The new 4th year will be introduced in 2000.*

3041
Chemical Engineering/Master of Commerce - Full-time Course
Bachelor of Engineering Master of Commerce

Same as course 3040
Total Credit Points 120

Stage 2
Same as course 3040
Total Credit Points 123.5

Stage 3
Same as course 3040
Total Credit Points 135

Stage 4

ACCT5901	Accounting: A User Perspective	3	0	15
ECON5103	Business Economics	0	3	15
	Commerce Core elective	3	0	15
CHEN4031	Environmental Management	13	0	9
CHEN4081	Design Project	6	0	18
CHEN4090	Research Project	3	9	36
CHEN4130	Professional Ellectives	3	3	18
SESC3310	Social Issues	0	2	5

Total HPW Session 1 21
Total HPW Session 2 17
Total Credit Points 131

3043
Chemical Engineering/MBiomedE - Full-time Course
Bachelor of Engineering Master of Biomedical Engineering

Provides route to BE in 4 years and MBiomedE in 5th year. Course is based on modified CHEN3040 with additional subjects in preparation for Masters. Students are advised that total credit points in Years 2, 3 and 4 are high. A summary is provided below with details in the section 'Graduate School of Biomedical Engineering'.

		CP
Year 1		
Course 3040 plus,		
BIOM1001	Professional Biomedical Studies	5
Total Credit Points 135		
Year 2		
Course 3040 (modified), plus		
BIOM9420	Clinical Laborotory Science	15
Total Credit Points		**138.5**
Year 3		
Course 3040 (modified), plus		
BIOM9311	Mass Transfer in Medicine	15
BIOM9321	Physiological Fluid Mechanics	15
PHPH2112	Physiology 1	30
Total Credit Points 151.5		
Year 4		
Course 3040 (modified), plus		
BIOM9410	Regulatory Requirements of Biomedical Technology	15
BIOM9332	Biocompatibility	15
BIOM5930	Research Project A	9
Total Credit Points	**151.5**	
Year 5		
BIOM5391	Research Project B	27
BIOM9060	Biomedical Systems Analysis	15
BIOM9440	Biomedical Practical Measurement	15
BIOM9932	Research Project C	30
CHEN4120	Plant Operation and Business Mgt	18
	Biomedical Electives	30
Total Credit Points	**135**	

3100
Industrial Chemistry - Full-time Course

Bachelor of Science
BSc

Industrial Chemistry is a four-year professional (prescribed) science course that is concerned with the application of science and technology to the chemical industry.

Successful completion of the course is accepted by the Royal Australian Chemical Institute and the Institution of Engineers, Australia as sufficient academic qualification for full corporate membership.

Various course patterns involving full-time and part-time study may be approved by the Director of Teaching and Learning.

		HPW S1	HPW S2	CP
Year 1				
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
INDC1020	Engineering 1 C*	6	6	30
MATH1131	Mathematics 1A	6	0	15
MATH1231	Mathematics 1B	0	6	15
PHYS1002	Physics 1	6	6	30
Total HPW Session 1	**24**			
Total HPW Session 2	**24**			
Total Credit Points	**120**			
Year 2				
CEIC2010	Instrumental Analysis	3	3	15
CEIC2020	Computing	3	0	7.5
CHEM2021	Organic Chemistry	3	3	15
CHEM2031	Inorganic Chemistry & Structure	3	3	15
CHEM2839	Inorganic Chemistry	0	6	15
INDC2010	Mass and Energy Balances	2	0	5
INDC2020	Introduction to Fluid Flow	3	0	7.5
INDC2030	Heat Transfer and Temperature Measurement	0	2	5
INDC2040	Physical Process Chemistry	6	0	15
MATH2021	Mathematics	2	2	15
MATH2819	Statistics SA	2	2	10
PHYS2920	Electronics	3	0	7.5
General Education subject/s		2	2	15
Total HPW Session 1	**30.5**			
Total HPW Session 2	**24.5**			
Total Credit Points	**147.5**			
Year 3				
BIOT3100	Fermentation Processes	2	0	5
CEIC3010	Reaction Engineering	0	3	7.5
CEIC4010	Process Economics 1	1	0	2.5
CHEM3829	Organic Chemistry	6	0	15
INDC3010	Thermodynamics	3	0	7.5
INDC3031	Experimental Design	0	3	7.5
INDC3041	Corrosion in the Chemical Industry	0	3	7.5
INDC3050	Chemistry of High Temperature Materials	0	2	5
INDC3060	Unit Operations	2	0	5
INDC3070	Instrumentation and Process Control 1	0	3	7.5
INDC3090	Chemistry of Industrial Processes	3	3	15
POLY3010	Polymer Science	3	3	15
General Education subject/s		2	2	15
Total HPW Session 1	**26**			
Total HPW Session 2	**22**			
Total Credit Points	**125**			
Year 4				
SESC3310	Social Issues in Applied Science‹	2	0	5
CEIC4020	Process Economics 2	1	0	2.5
INDC4040	Management	2	0	5
INDC4060	Process Design‹	3	4	17.5
INDC4070	Laboratory Automation Science	4	0	10
INDC4080	Seminars	2	2	10
INDC4090	Project (IC)	8	16	60
INDC4130	Environmental Chemistry of Industrial Processes‹	2	0	5
POLY4010	Advanced Polymer Science	2	0	5
General Education subject/s		0	2	7.5
Total HPW Session 1	**26**			
Total HPW Session 2	**24**			
Total Credit Points	**127.5**			

‹These subjects contribute towards satisfaction of the General Education Requirement

Part-time courses

Six-year part-time courses leading to the award of the degree of Bachelor of Science (Technology) in Chemical Engineering and in Industrial Chemistry are intended for students who are employed in relevant industries and who wish to prepare for a degree mainly by part-time attendance.

As part of the requirements for the award of the BSc(Tech) degree, students are required to complete an approved program of industrial training of not less than one year prior to the award of the degree. Industrial training should normally be completed concurrently with attendance in the course, but with the approval of the Head of School, may be completed after completion of the prescribed course of study.

Students who qualify for the award of the BSc(Tech) degree and who wish to proceed to the award of a BSc or BE degree will normally be required to complete further work which will involve at least one year of full-time attendance.

Holders of the degree of BSc(Tech) or BSc(Eng) will be eligible to proceed to the award of the degree of Master of Science or Master of Engineering, subject to the regulations relating to these degrees.

Transfer is also possible from full-time courses to the part-time BSc(Tech) degree course, but a period of approved industrial experience must be gained before graduation. This requirement will apply to students transferring from BSc and BE degree courses within the Faculty.

Details of part time courses can be obtained from the Director of Teaching and Learning.

3110
Industrial Chemistry - Part-time Course

Bachelor of Science (Technology)
BSc (Tech)

Part time courses consist of first 3 years of the respective full time course – undertaken over a six year period.

Details of part time courses can be obtained from the Director of Teaching and Learning.

Postgraduate Study

Course Outlines

Formal courses in the School of Chemical Engineering and Industrial Chemistry lead to the award of the Master of Engineering Science in Process Engineering 8016.

The School welcomes enquiries from graduates interested in pursuing research for the award of the degrees of:

PhD	
Chemical Engineering	1010
Industrial Chemistry	1016
MSc	
Chemical Engineering	2010
Industrial Chemistry	2016
ME	
Chemical Engineering	2150

Master of Engineering Science Degree Courses

The MEngSc degree courses involve a project which must integrate and apply the principles treated in the course. It may take the form of a design feasibility study or an experimental investigation. Evidence of initiative and of a high level of ability and understanding is required in the students approach, and the results must be embodied in a report and submitted in accordance with the Universitys' requirements.

8016
Process Engineering

Master of Engineering Science
MEngSc

The course will involve full time study at UNSW for overseas students for a period of one year. Australian citizens or permanent residents may elect to take the course in a series of modules over a somewhat longer period. The degree can be obtained by taking a combination of subjects to a minimum number of 120 credit points.

Students with a recognised 4 year BE or BSc degree OR students with a recognised 3 year BE or BSc plus satisfactory industrial experience OR students who submit satisfactory evidence of other academic or professional attainments will be permitted to enrol.

Whilst the program is aimed at maximum flexibility four subjects will be considered as core subjects. These are CEIC5310 Computing Studies in Process Industries, CEIC5311 Instrumental Analysis in Process Industries, CEIC5312 Safety and Communication in the Process Industries, and CEIC5313 Environmental Technologies in Process Industries.

These core subjects could be substituted if a student can demonstrate skills in these areas. The core subjects will be offered at periods most convenient to the resource utilisation of the School. 30 credit points can be taken as electives which may be given as one week intensive courses.

A 30 credit point project on relevant aspects of process industries, supervised by academic members of staff may be undertaken. Assessment of the project report will be undertaken by 2 staff members.

Each student program must be approved by the Head of School or Graduate Studies Coordinator.

The fee for the entire MEngSc program is $16000. Fees for Australian citizens or permanent residents will be initially set at $500 per credit point.

Core subjects (15 credit points)

CEIC5310	Computing Studies in the Process
CEIC5310	Computing Studies in the Process Industries
CEIC5311	Instrumental Analysis in the Process Industries
CEIC5312	Safety and Communications in the Process Industries
CEIC5313	Environmental Technologies

Project (30 credit points)

CEIC5320	Process Engineering Project

Elective subjects (15 credit points)
two to be chosen

CEIC5330	Process Engineering and the Petroleum Industry
CEIC5331	Process Engineering: Natural Gas and Light
CEIC5332	Process Engineering in the Food Industry
CEIC5335	Advanced Computer Methods in the Process Industries
CEIC5336	Environmental Chemistry in the Process Industries
CEIC5337	Particle Characterisation in the Process Industries
CEIC5340	Polymer Synthesis: Fundamentals and Techniques
CEIC5341	Membrane Technology in the Process Industries
CEIC5333	Experimental Design in the Process Industries

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 ÎHandbook Guideì, appearing earlier in this book.

Graduate subjects will only be offered if class numbers exceed 5 and some graduate subjects will only be offered every alternate year. Contact School for further details.

SESC 3310
Social Issues in Science and Technology
Staff Contact: School Office
CP5 S1 2HPW

The subject covers social issues arising from future technological developments and the role that a professional applied scientist can play in influencing future directions. It will be taught by a combination of group activity, case studies and projects and seminars from visiting speakers, some of whom will be from disciplines other than the applied sciences.

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: Dr R Amal
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.

CEIC2010
Instrumental Analysis
Staff Contact: A/Prof M Brungs
CP15 F L1 T2
Prerequisites: PHYS1002, CHEM1101 and CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEN1020 or INDC1020

Data treatment, error analysis and propagation of errors. Basic principles of volumetric analysis. Solubility and pH calculations. Electronic analysis potentiometric, voltametric and coulometric. Spectrophotometric – analysis UV/visible, atomic emission, atomic absorbtion, X ray diffraction and fluorescence. Chromatographic analysis, gas chromatography, high performance liquid chromatography, and ion chromatography.

CEIC2020
Computing
Staff Contact: Dr T Pham
CP7.5 S1 L1 S2 L1 T1
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEM1101 and CHEM1201, PHYS1002, CHEN1020 or INDC1020

Computing for technical applications. Operating systems. The Pascal language Elementary numerical methods; library subprograms; structures of program modules for technical calculations.

CHEN2060
Introduction to Process Chemistry
Staff Contact: A/Prof R Chaplin
CP6.5 S1 L1.5 T1
Prerequisites: PHYS1002, CHEM1101 and CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEN1020 or INDC1020

Definitions of classical thermodynamics. Pressure-volume -temperature properties of industrially important fluids. Applications of thermochemistry in industry. Conversion of heat into work. Concept of lost work. Heat engines and refrigeration cycles. General properties of solutions. Maximum conversion of reactants in batch and flow reactors. Reactor design and chemical kinetics. Reaction rates in industrial batch and flow reactors. Electrochemical principles in the context of important industrial electrochemical processes. Properties and applications of electrolytes. Industrial electrochemical processes, electrodes and cells. Surface phenomena. Survey of the organic and inorganic chemistry of industrially important products. An integrated laboratory incorporating experiments designed to demonstrate the principles covered in the lecture material.

CEIC3010
Reaction Engineering
Staff Contact: Prof N Foster
CP7.5 S2 L2 T1
Prerequisites: CEIC2020, CEIC2030, CEIC2040, CHEN2010 or INDC2010, CHEN2020 or INDC2020, CHEN2030 or INDC2030

Introduction to reactor design: ideal batch, steady state mixed flow, steady state plug flow, size comparisons of ideal reactors, optimisation of operating conditions. Multiple reactor systems: reactors series and parallel, mixed flow reactors of different sizes in series, recycle reactors, autocatalytic reactions. Multiple reactions: reactor design for reaction in parallel and reactions in series, series-parallel reactions. Temperature effects: heat of reaction, equilibrium

constants, optimum temperature progression, adiabatic and non-adiabatic operation, product distribution and temperature. Kinetics of rate processes: Significance of the rate laws and models for distributed and lumped parameter systems. Experimental measurement and correlation of process rates.

CEIC4010
Process Economics 1
Staff Contact: A/Prof T Tran
CP2.5 S1 L1

Consists of the segment Process Economics CHEN3060 Process Plant Engineering 1

CEIC4020
Process Economics 2
Staff Contact: A/Prof T Tran
CP2.5 S2 L1

Project economic evaluation. Discounted cash flow methods. Project financing. Sensitivity analysis and uncertainty. Financial and cost accounting methods.

CEIC4070
Laboratory Automation for Ceramic Engineers
Staff Contact: A/Prof. T Tran
CP5 S1 L1 T1
Note/s: Servicing subject i.e. a subject taught within courses offered by other faculties.

Application of microprocessors to laboratory automation. Basics of computing hardware and process interface hardware (A/D D/A conversion, digital 1/0 etc.) Elements of real-time computing and software associated with the process interface. Real-time data acquisition, signal processing, discrete and sequential control of selected relevant example processes.

CEIC4200
Industrial Experience
Staff Contact: Dr T Pham
CP40

Students in the four-year courses must obtain a minimum of twelve weeks professionally oriented or industrial experience prior to the award of the degree.

CEIC4210
Industrial Experience
Staff Contact: Dr T Pham
CP0

Students in the BSc (Tech) course in Industrial Chemistry must complete an approved program of industrial experience of not less than twelve months prior to the award of the degree.

CEIC5000
Major Project
Staff Contact: Prof R Burford
CP30

A substantial project on some aspects of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

CEIC5010
Minor Project
Staff Contact: Prof R Burford
CP15

A minor investigation on some aspect of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

CEIC5310
Computing Studies in the Process Industries
Staff Contact: Dr T Pham
CP12

Introduction to computing systems. Hardware, personal computers, software. Operating systems: DOS, Windows. Languages: Basic, Pascal. Introduction to computing applications: Word Processing, Spreadsheets, Data bases, Equation Solvers with specific reference to solution of Process Engineering problems.

CEIC5311
Instrumental Analysis in the Process Industries
Staff Contact: A/Prof M Brungs
CP12

The course will encompass both chemical and physical analysis of materials. The basic principles of laboratory and on-line instrumentation will be examined and this material will be reinforced by appropriate laboratory classes. Selected topics include: analyses of and for water, colour, density and viscosity, spectroscopic, electrochemical and chromatographic techniques. The course will also include aspects of sampling and Laboratory Information Management Systems (LIMS).

CEIC5312
Safety and Communications in the Process Industries
Staff Contact: Prof D Trimm
CP12

Toxicity of chemicals. Material safety data sheets. Storage of hazardous materials. Disposal of hazardous materials. Air pollution and ventilation, electrical and mechanical aspects of machinery. General laboratory safety. Fire precautions in laboratories. Fire fighting training. The principles of hazard analysis and hazardous operations. Safety with large scale equipment. Plant visits. Oral and written communication. The basis of writing proposals and reports. Error analysis. Verbal presentations to small and larger audiences. Use of slides and overheads.

CEIC5313
Environmental Technologies
Staff Contact: Prof A Fane
CP12

This subject deals with conventional and advanced separation processes for pollution control, effluent treatment and waste minimisation in the Process Industries. Topic areas covered will be selected from:

Gravity Separations, Filtration Processes, Sorption Processes, Extraction Processes, Membrane Technology,

Biological Processes, Design, Control and Monitoring, Clean Production Technologies.

CEIC5320
Process Engineering Project
Staff Contact: A/Prof R Chaplin
CP48

An investigation of a problem in any area related to process engineering which involves a significant research or design component. Such an investigation should be related to the research interests and expertise of Staff in the School of Chemical Engineering and Industrial Chemistry. If the student chooses a research project, a course on research methods must also be taken.

CEIC5330
Process Engineering in the Petroleum Industry
Staff Contact: Dr A Adesina
CP12

1. Origin and nature of crude oil overview of the Petroleum refinery. 2. Petroleum processing operations Hydrotreating, desulphurisation, denitrogenation, demetallation, deoxygenation, hydrocracking. Process description flow sheet, hydrogen supply, operating conditions, reactor types. 3) Catalytic cracking: Feed classification, supply and associated reactions. Mechanism of catalytic cracking. Cracking catalysts bifunctionality, properties, testing, coking and longevity. Process Engineering operating variables, reactor types and arrangement, design of fluid catalytic crackers. 4) Catalytic Reforming: Thermodynamics of catalytic reforming Individual reactions. The balance between catalyst efficiency and catalyst life. Catalysts. Deactivation. Reactor design. Residue Processing. Production of fuels, residues and carbon.

CEIC5331
Process Engineering: Natural Gas and Light Hydrocarbons to Petrochemicals
Staff Contact: Dr A Adesina
CP12

Feedstock for the petrochemical industry. Natural gas, synthesis gas, LPG, C4 hydrocarbons. Syngas production. Steam reforming, carbon dioxide reforming, water gas shift, partial oxidation. Process based on C1 chemistry catalysts, processes and reactors. Methanation and Fischer-Tropsch synthesis, methanol synthesis. Olefin production (ethylene, propylene and butene). Steam cracking, catalytic cracking, thermal dehydrogenation, catalytic (oxidative) dehydrogenation. Manufacture of base petrochemicals. Synthesis of ethylene oxide, aldehydes and acetic acid production, hydroformylation, hydration and halogenation compounds. Manufacture of vinyl monomers and condensation polymer feedstocks.

CEIC5332
Process Engineering in the Food Industry
Staff Contact: Dr T Pham
CP12

This course covers the application of process engineering techniques in the food industry, with its particular emphasis on product sensory quality and hygiene. The topics considered will include evaporation and drying, separation, refrigeration, thermal processing, prediction of quality and microbiological changes, and computer techniques. The course will include lectures, assignments and one major design project.

CEIC5333
Experimental Design in the Process Industries
Staff Contact: A/Prof R Chaplin
CP12

This course is structured to provide a sound introduction to the fundamentals of experimental design and its impact on productivity and quality in research development and manufacturing processes. Topics covered will include: basic statistical hypothesis testing, quality control, control charts, regression analysis, factional designs, fractional factional designs, screeing designs, linear and curve-linear models, non-linear models, Taquchi concepts, optimisation, response surface concepts.

CEIC5335
Advanced Computer Methods in the Process Industries
Staff Contact: A/Prof R Chaplin
CP12

Solution of Process Engineering problems, trouble-shooting and Process Design utilising advanced computer applications including flowsheeting, numerical methods, statistical design, CAD and process integration.

CEIC5336
Environmental Chemistry in the Process Industries
Staff Contact: Dr P Crisp
CP12

Introduction to the chemical processes underlying major problems. The following topics will be covered: soil chemistry, acid rain, land degradation, urban air pollution, ozone depletion, global climatic change, radioactive contamination, alternative energy sources, chemical waste contamination, toxic elements, toxic organics, absorption processes and occupational diseases. The role of the chemical industry in causing and resolving the problems will be examined.

CEIC5337
Particle Characterisation in the Process Industries
Staff Contact: Dr R Amal
CP12

This course will cover theoretical principles and practical aspects of methods of characterising fine particulate materials. Characteristics investigated include: particle size and size distribution, density, porosity, surface area, zeta potential and electrostatic charge, morphology and structure. Techniques covered include: sedimentation, optical techniques, electrozone sensing, image analysis, time of flight analysis, inertial impaction, mercury porosimetry, gas adsorption, helium pycnometry, morphological analysis. Practical examples of industrial applications will be given together with laboratory demonstrations using all the techniques.

CEIC5340
Polymer Synthesis: Fundamentals and Techniques
Staff Contact: A/Prof R Chaplin
CP12

Polymerisation fundamentals: radical chain polymerisation, ionic chain polymerisation, Ziegler-Natta polymerisation of olefins, step growth polymerisation, production of polyesters, polyamides, polycarbonates and polyurethanes. Polymerisation Processes: bulk emulsion, solution and suspension polymerisation of vinyl monomers, specialised techniques for ionic and coordination polymerisations, condensation polymerisation.

CEIC5341
Membrane Technology in the Process Industries
Staff Contact: Prof A Fane
CP12

Classification of membranes and membranes processes. Driving forces and mass transfer mechanisms. Characterisation for membranes. Control of concentration polarisation and fouling. Aspects of the design of membranes, membrane modules and membrane systems. Operating principles of major membrane processes include microfiltration, ultrafiltration, nanofiltration, reverse osmosis, dialysis, electrodialysis, membrane distillation, pervaporation, gas permeation, liquid membranes. Selected applications and economic aspects of membrane technology in the fields of biotechnology, biosensors (including bioreactors), controlled release, chemical and food processing, water and waste treatment.

CEIC5342
Energy Management in the Process Industries
Staff Contact:
CP12

Examination of all aspects of the energy management process engineering plants and the impact on environmental emissions. Topics to be covered include: combustion of solid, liquid and gaseous fuels, energy balances around, furnaces, energy audits, heat return and heat recovery in process plants.

CEIC5630
Industrial Water and Wastewater Engineering
Staff Contact: Prof AG Fane
CP12 S2 L3

Environmental consequences of water pollution. Water quality criteria and regulations related to industrial use and disposal. Water sources and requirements of industry. Theoretical and practical aspects of treatment methods, including screening, sedimentation, oil separation, coagulation and flocculation, filtration, biological treatment, adsorption, ion exchange, membrane processes. Strategies for industry including waste surveys, prevention at source, correction before discharge water reuse. Economic aspects. Seminars. Factory visits/ laboratory.

CEIC5890
Graduate Colloquia
Staff Contact: School Office
CP24

Colloquia on research developments in the School of Chemical Engineering and Industrial Chemistry. Students are required to participate actively in the colloquia and give at least one dissertation based on their own investigations.

CEIC5900
Specialist Lectures
Staff Contact: School Office
CP24

CEIC5930
Safety in Laboratories
Staff Contact: A/Prof R Chaplin
CP4 S1

Storage of hazardous materials. Disposal of hazardous materials. Air pollution and ventilation. Electrical and mechanical aspects of machinery. General laboratory safety. Microbiological safety precautions. Toxicology. Carcinogens and safety. Ionising and non-ionising apparatus. Protective clothing. Precautions against hearing loss. Chemistry and physics of flames. Fire precautions in the laboratories. Fire fighting training.

CHEN 1010
Introduction to Chemical Engineering

Staff Contact: Prof A G Fane
CP12.5 SI L2 T1 S2 L1 T1

Introduction to basic Chemical Engineering concepts, design, flowsheets, safety and environmental issues. The Chemical Engineering profession, ethics and careers. Laboratory, Pilot Plant and Industry visits. Case studies of the chemical process industry.

Introduction to material and energy balances. Basic calculations associated with chemical process operations. Units, stoichiometry, composition, pressure, ideal gases, equations of state, phase equilibria, thermal properties, steam tables.

Introduction to computing and the student computing facilities, including the use of word processing and spreadsheets in Chemical Engineering. Overview of the use of computers in Chemical Engineering. An introduction to computer programming.

CHEN 1020
Engineering 1 CE
Staff Contact: Dr T Pham
CP30 F L3 T3

This subject comprises CHEN 1010 Introduction to Chemical Engineering, MECH 0130 Engineering Drawing and Descriptive Geometry and MECH 0330 Engineering Mechanics.

Each subject is described elsewhere in this handbook. Prospective students should note that it is not necessary to pass each of the three component subjects individually. However, for a student who does not pass all components

separately, the composite mark for the whole subject is not calculated by a simple averaging process. For a component subject in which a passing mark is not obtained, heavier weighting is applied; the lower the mark the heavier the weighting. The details of the calculation method are explained in the first week of the subject. A student who is repeating the subject after failure must repeat all three components. No exemptions will be granted for components that were passed at an earlier attempt.

CHEN 2010
Material and Energy Balances
Staff Contact: A/Prof M Brungs
CP10 F T1 L1
Prerequisites: CHEM1201, CHEN1020 or INDC1020, MATH1231 or MATH1241, PHYS1002

Solution strategies for material and energy balance problems. Material Balances: Component, elemental and differential material balances. Problems involving bypass, recycle, purge and chemical reaction. Energy Balances: Thermodynamic background: first law; general equation for open and closed systems; shaft work and enthalpy; reference states. Application of energy balances: enthalpy data including steam tables and psychrometric charts; heat capacity data; phase change; mixing; heat of solution; enthalpy-concentration diagrams; heats of formation, combustion and reaction. Integrated material and energy balance problems including a case study of an industrial process. Students not taking CHEN1010 will be required to complete a 28-hour bridging course offered by the School early in Session 1.

CHEN 2020
Flow of Fluids
Staff Contact: Dr R Amal
CP10 S1 L2 T2
Prerequisites; CHEM1201, CHEN1020 OR INDC1020, MATH1231 OR MATH1241, PHYS1002

Dimensional Analysis. Fundamental concepts of Fluids. Simplification of the Navier-Stokes Equation. Fluid Statics. Integral Equations; continuity, Bernoulli's equation, momentum and energy equations. Flow in closed conduits, including laminar and turbulent flow and losses due to friction. Boundary layer theory. Measurement in Fluid mechanics; viscosity, pressure, velocity, flowrate. Pumps and pumping; blowers, compressors, pipes and fittings.

CEIC 2020
Computing
Staff Contact: Dr T Pham
CP9 S1 L2 T1
Prerequisites: MATH1231 or MATH1241, CHEM1201, PHYS1002, CHEN1020 or INDC1020

Computing for scientific and chemical engineering applications using Pascal. Brief review of basic computer concepts. The Pascal language. Applications in chemical engineering and industrial chemistry such as the solution of heat transfer and chemical reaction problems.

CHEN 2031
Heat and Mass Transfer
Staff Contact: Dr R Sheikholeslami
CP10 S2 L3 T1
Prerequisites: PHYS1002, CHEN1020, or INDC 1020, CHEM1201, MATH1231 or MATH1241

Introduction to various modes and mechanisms of heat and mass transfer. Physical origins and rate equations. Conductivity and diffusivity. Diffusional heat and mass transfer based on shell balances approach for one-dimensional steady state and transient transfer with heat generation and chemical reactions. Composite walls, contact resistance and extended surfaces. Analogies between Heat and Mass Transfer Applications: Introduction to heat exchangers; log-mean temperature difference, effectiveness - NTU methods.

CHEN 2050
Chemical Engineering Practice 1
Staff Contact: A/Prof T Tran
CP7.5 S2 T3
Prerequisites: CHEN1201, CHEN1020 or INDC1020, MATH1231 or MATH1241, PHYS1002

An introduction to laboratory work in chemical engineering including technical report writing, flowsheet preparation, information retrieving and data processing techniques. Experiments in this subject are designed to demonstrate principles of industrial processes. Industrial operations are also analysed via reports from literature or multimedia, including videos.

CHEN 2060
Introduction to Process Chemistry
Staff Contact: A/Prof R P Chaplin
CP20 S1 L4 T2 S2 L2
Prerequisites: PHYS1002, CHEM1201, MATH1231 or MATH1241, CHEN1020 or IND1020

Definitions of classical thermodynamics. Pressure-volume -temperature properties of industrially important fluids. Applications of thermochemistry in industry. Conversion of heat into work. Concept of lost work. Heat engines and refrigeration cycles. General properties of solutions. Maximum conversion of reactants in batch and flow reactors. Reactor design and chemical kinetics. Reaction rates in industrial batch and flow reactors. Electrochemical principles in the context of important industrial electrochemical processes. Properties and applications of electrolytes. Industrial electrochemical processes, electrodes and cells. Surface phenomena. Survey of the organic and inorganic chemistry of industrially important products. An integrated laboratory incorporating experiments designed to demonstrate the principles covered in the lecture material.

CHEN 2070
Instrumental Analysis for Chemical Engineers
Staff Contact: A/Prof M Brungs
CP 10 F L1 T1
Prerequisites: PHYS1002, CHEM1201, MATH1231 or MATH1241, CHEN1020 or INDC1020

Data treatment. Sampling of solids, liquids and gases. Volumetric analysis, gravimetric analysis, solubility calculations, crystal nucleation and growth. Basic electrochemistry and electrochemical analysis including potentiometric, voltametric and coulometric techniques. Spectrophotometric analysis - UV/Visible, atomic absorption, atomic emission, Xray diffraction and fluorescence. Chromatographic analysis - gas chromatography, high performance liquid chromatography and liquid chromatography.

CHEN 3011
Engineering Thermodynamics
Staff Contact: Dr V Chen
CP9 S1 HPW3
Prerequisites: CHEN2060, CHEN2010, CHEN2020

Review of first law of thermodynamics; second law of thermodynamics. Auxiliary functions and conditions of equilibrium. Thermodynamic properties of fluids; thermodynamic properties of homogeneous mixtures. Chemical reaction equilibria; calculation of equilibrium compositions for single reactions. Phase equilibria; the phase rule, equilibrium. Engineering applications of thermodynamics. Heat engines, refrigeration.

CHEN 3020
Process Modelling and Optimisation
Staff Contact: Dr A Adesina
CP9 S2 HPW3
Prerequisites: CEIC2020, MATH2031, MATH2899

Techniques to solve models of chemical and mineral processes, and process optimisation with respect to financial and environmental objectives. The concepts of solution to process models covered include solution of single and multiple linear and nonlinear equations, numerical solution of ordinary differential equations, and parameter estimation from process data. The concepts of process optimization covered include single and multiple dimensional nonlinear optimization, linear programming, and dynamic programming. The methods are taught using examples of common applications of the presented concepts in the chemical and mineral processing industries.

CHEN 3031
Advanced Transport Phenomena
Staff Contact: Dr A Adesina
CP9 S2 L2 T1
Prerequisites: CEIC2020, CHEN2020, CHEN2031, MATH2031

This subject is an extension of material given in CHEN2020 Flow of Fluids, and CHEN2031 Heat and Mass Transfer. Review of the analogy between mass, momentum and thermal transport. Derivation of the equations of change for: Isothermal systems - continuity and equation of motion, Non-isothermal systems - forced and free convection. Multicomponent systems. Case studies: Cone-and-plate viscometer, Vortex prediction in a stirred tank, Transpiration cooling, Free convection heat transfer from a vertical plate; simultaneous heat and mass transfer; drying. Mass transfer with chemical reaction. Transient analysis of transport phenomena: Viscous laminar flow, Heat conduction in solids. Diffusion - Evaporation and unsteady-state diffusion with chemical reaction. Two-dimensional transport problems. Power law fluids - momentum and thermal transport.

CHEN 3041
Particle and Separation Processes
Staff Contact: Dr F P Lucien
CP18 S1 L2 T2 S2 L1 T1
Prerequisites: CHEN2010, CHEN2020, CHEN2031, CHEN2050, CHEN2060

Stagewise separation processes: binary distillation, liquid-liquid extraction, solid-liquid extraction and absorption. HTU/NTU methods for the design and analysis of packed columns. Surface separation processes. Phase equilibria for multicomponent systems. Multicomponent separation: graphical methods, shortcut methods and rigorous computer techniques for the design and analysis of stagewise separation processes. Azeotropic and extractive distillation. Synthesis of separation sequences. Energy conservation in separation systems.

Particle size analysis. Fluid-particle interactions: drag coefficient, effect of Reynolds number. Terminal velocity, effect of shape and concentration. Drops and bubbles. Particle-particle interactions including flocculation. Flow through porous media. Darcy, Carman-Kozeny, Ergun equations. Application of fluid-particle systems: Sedimentation and thickening. Elutriation. Cyclones. Packed beds. Single phase flow. Two phase flow in trickle beds. Filtration: constant pressure theory, specific resistance, equipment filter aids, centrifugal. Fluidisation: minimum fluidisation velocity, two phase theory, bubble properties, applications. Spouting. Pneumatic and hydraulic conveying. Solids handling: Properties of granular solids and powders affecting storage and movement. Stockpiles, silos and hoppers: Feeders, convey or belts and elevators.

CHEN 3064
Process Design and Economics
Staff Contact: Dr D Wiley
CP18 S1 L3 S2 L2 T1
Prerequisites: CHEN2010, CHEN2020, CHEN2031, MATH2031

Process development and simulation: All activities required from the conception of the idea to produce a product through to the finalisation of the process flow diagram including process selection and evaluation, process design, process simulation (both steady-state and dynamic including the use of industrial simulation packages) and process representation. Process materials: The use, performance limits and selection of metals, plastics, refractories, ceramics and glass in construction of process

plants. Corrosion, strength of materials, use of codes and standards. Process economics: Capital and operating costs of a process plant. Fixed and variable costs. Break-even analysis. Cost estimation methods. Project financing. Process control: Development and representation of control schemes for process plant. Process safety: Techniques for assessing safety and risk of existing and proposed process plants. Systems reliability, HAZOP and HAZAN. Pressure and explosion relief. Laboratory safety.

CHEN 3065
Plant and Equipment Design
Staff Contact: Dr D Wiley
CP12 S1 L1 T1 S2 L2
Prerequisites: CHEN2010, CHEN2020, CHEN2031, MATH2031

Procedures for the selection, design, specification, construction and representation of process equipment according to engineering standards and procedures: Pressure vessels. Heat exchangers, heat exchanger networks, optimum energy utilisation. Absorption, distillation, liquid-liquid extraction and adsorption involving stagewise and differential contact. Membrane and other surface separation processes. Cooling towers. Drying. Fixed bed catalytic reactors in adiabatic, non-adiabatic and non-isothermal operation; trickle bed reactors; slurry reactors for batch and continuous operation.

CHEN 3071
Process Control
Staff Contact:
CP12 S2 HPW4
Prerequisites: CEIC2020, MATH2031, CHEN3110

Concepts of process control, including: dynamic modelling of processes, linearization, Laplace transforms, transfer functions, open loop response of first and higher order systems, approximation by first order plus deadtime models, concept of control for process regulation and safety, feedback control, block diagrams, PID controllers and tuning methods, closed loop response, stability analysis, single input-single output control loop design, cascade control, feedforward control, control valve characteristics and sizing, as well as introduction to some advanced control concepts.

CHEN 3080
Chemical Engineering Practice 2
Staff Contact: Dr J Stubington
CP9 S1 T2 S2 T1
Prerequisites: CHEN2070, CHEN2060, CHEN2010, CHEN2020, CHEN2031, CHEN2050, CEIC 2020, MATH 2031, MATH 2899

An integrated chemical engineering laboratory incorporating experiments in fluid flow, heat/mass transfer, thermodynamics and kinetics, mineral processing and process control. The objectives of the experiments are to demonstrate, reinforce and extend the principles of chemical engineering which are used in the investigation of chemical engineering problems and to develop an interest in experimentation and efficiency in writing technical reports and presenting technical seminars.

CHEN 3100
Kinetics and Chemical Reaction Engineering
Staff Contact: Prof N R Foster
CP12 F HPW2
Prerequisites: CEIC2020, CHEN2010, CHEN2020, CHEN2031, CHEN2060

Introduction to reactor design. Kinetics of rate processes - elementary reactions, reaction order, molecularity and non-elementary reactions. Collection and analysis of rate data. Batch systems, constant volume reactions, flow systems, reactions with volume change. Ideal reactors-batch, mixed flow and plug flow modes. Multiple reactor systems-series, parallel, series-parallel combinations. Complex reaction networks- concept of selectivity and yield. Non-ideal chemical reactors-residence time distribution. Unsteady state analysis of CSTR and PFR. Temperature effects- heats of reaction, optimum temperature progression path. Non-isothermal reactor design- adiabatic and non-adiabatic reactors. Steady-state multiplicity analysis in chemical reactors. Non-catalytic gas-solid reactions, the Shrinking core model. Introduction to heterogeneous catalysis. Transport effects in heterogeneous reactions-external and pore diffusion resistances, criteria for collecting transport-free kinetic data. Design of fixed bed catalytic reactors.

CHEN 3110
Systems Modelling and Analysis
Staff Contact: Dr A Adesina
CP7.5 S1 HPW2
Prerequisites: CHEN 2031, CHEN 2060, CHEN 2010, CHEN 2020, CHEN 2050, CHEN 2031, MATH 2031

Mathematical tools used in the modelling and analysis of chemical, mineral, and environmental processes. Fundamental modelling of chemical, mineral, and environmental systems, based on physical laws, including modelling of lumped systems, discrete systems, multivariable systems, and distributed parameter processes. Application of mathematical analysis tools including: matrix and vector operators, solution of ordinary and partial differential equations, linearization methods, and functional analysis to the solution of problems in the chemical, mineral and environmental engineering fields. Statistical applications including parameter estimation, empirical modelling, data driven models, and design of experiments.

CHEN4010
Separation Processes 2
Staff Contact: Dr T Pham
CP5 S1 L1 T2
Prerequisites: CHEN3010, CHEN3020, CHEN3040, MATH3021

Separation of multi-component systems by statewise operations. Multi-component separations using modern computer techniques. Phase equilibbrium relationships for liquid-vapour and liquid-liquid systems. Azeotropic and extractive distillation.

CHEN4030
Environmental Pollution Control
Staff Contact: Prof A Fane
CP5 S1 L2
Prerequisites: CHEN3030, CHEN3040, CHEN3050, CHEN306

Water pollution design and operation strategies; treatment operations; economic aspects. Air pollution-effluent dispersions: types of gas cleaning units, choice of gas cleaning equipment. Noise pollution and pollution control legislation.

CHEN4070
Process Dynamics and Control
Staff Contact: Dr D Wiley
CP15 S1 T3 S2 T3
Prerequisites: All Year 3 subjects

Safety; techniques for assessing safety of existing and proposed plants. Systems reliability, HAZOP and HAZAN. Pressure and explosion relief, laboratory safety. This project will cover the engineering of a small process plant or part thereof requiring the application of material covered within the undergraduate course. The minimum requirements of this project are as specified by the relevant Engineering institutions accreditation standards.

CHEN4081
Design Project
Staff Contact: Dr D Wiley
CP15 S1 T3 S2 T3
Prerequisite: All Year 3 subjects

Safety: Techniques for assessing safety of existing and proposed plants. Systems reliability, HAZOP and HAZAN. Pressure and explosion relief, laboratory safety. This project will cover the engineering of a small process plant or part thereof requiring the application of material covered within the undergraduate course. The minimum requirements of this project are as specified by the relevant engineering institutionìs accreditation standards.

CHEN4090
Research Project
Staff Contact: Dr D Wiley
CP30 S1 T2 S2 T10
Prerequisites: All Year 3 subjects

The experimental investigation of some aspect of chemical engineering.

CHEN4100
Professional Electives
Staff Contact: A/Prof T Tran
CP15 F L2 T1
Prerequisite: All Year 3 subjects

To be chosen from offerings in: Bioprocessing; Business Management in Chemical Engineering; Environmental Management; Fuels and Energy (graduates may qualify for membership of the Australian Institute of Energy); Minerals Engineering (graduates may qualify for membership of the Australian Institute of Mining and Metallurgy).

CHEN4120
Process Plant Management and Operation
Staff Contact: Dr R Amal
CP15 F L1 T2
Prerequisite: All Year 3 subjects.

The management and practical operation of computer controlled chemical plant. Experience is gained in business practices including: company types, structure and organisation, company financing and operation, personnel management, accounting, company law, industrial relations and trade union practices, marketing. A Business Plan is written and company liquidation is undertaken. Product development and quality management issues are covered.

FUEL0040
Fuel Engineering for Ceramic Engineers
Staff Contact: Dr JF Stubington
CP5 F L1 or S1 L2

An introduction tc combustion technology, combustion calculations, burner design, furnace, kiln and boiler thermal design.

FUEL0050
Fuel and Energy Engineering for Process Metallurgy
Staff Contact: Dr JF Stubington
CP7.5 S1 L2 S2 L1

An introduction to combustion technology, fuel plant technology and fuel processing.

FUEL5800
Fuel Seminar
Staff Contact: Dr JF Stubington
CP4
Note/s: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks.

1 (SU) to be given in Session 2, compulsory in MAppSc degree course in Fuel Engineering. Content bias to choice of subjects.

FUEL5820
Fuel Constitution
Staff Contact: Dr JF Stubington
CP16
Note/s: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks. Select from following units:

Unit 1 – 1 (SU) Coal constitution and pyrolytic behaviour.
Unit 2 – 1 (SU) Constitution and classification of oils.
Unit 3 – 2 (SU) Advanced fuel constitution.

FUEL5830
Fuel Processing
Staff Contact: Dr JF Stubington
CP16
Note/s: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks. Select from following units:

Unit 1 – 2 (SU) Carbonisation and gasification processes.
Unit 2 – 1 (SU) Liquid fuels from coals.
Unit 3 – 1 (SU) Chemicals from coals.

FUEL5840
Fuel Plant Engineering
Staff Contact: Dr JF Stubington
CP24
Note/s: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks. Select from following units:

Unit 1 – 1 (SU) Furnace design and heat recovery.
Unit 2 – 1 (SU) Process heat transfer and efficient use of steam.
Unit 3 – 2 (SU) Furnaces and boiler control system.
Unit 4 – 2 (SU) Fuel plant heat transfer.

FUEL5850
Combustion and Energy Systems
Staff Contact: Dr JF Stubington
CP16
Note/s: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks. Select from following units:

Unit 1 – 1 (su) combustion technology.
Unit 2 – 1 (su) fuel impurities, removal of and deposits from.
Unit 3 – 1 (su) efficiency in energy utilisation.
Unit 4 – 1 (su) combined cycles and integrated systems.

FUEL5870
Fuel Technology Practice
Staff Contact: Dr JF Stubington
CP16
Note/s: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks.

Compulsory in MAppSc (Fuel) (4 SU).

FUEL5880
Unit Operations in Wastewater, Sludge and Solid Waste Management
Staff Contact: Dr JF Stubington
CP12

Physical wastewater treatment processes including sedimentation, flotation, flocculation, precipitation. Sludge management including conditioning, filtering, lagoons, drying. Introductory fuel engineering. Combustion principles. Incineration. Pyrolysis. Gasification. Resource recovery and recycling. Incinerator and afterburner design. Wastewater and sludge components given in Civil Engineering.

FUEL5881
Unit Operations in Wastewater, Sludge and Solid Waste Management
Staff Contact: Dr JF Stubington
CP12

Syllabus as for FUEL5880. FUEL5881 is for external students in waste management courses.

FUEL5910
Atmospheric Pollution and Control (Theory)
Staff Contact: Dr JF Stubington
CP12 S1 or S2 L3

Causes, properties, dispersion, measurement and monitoring control and legislation of air pollution in ambient and industrial environments.

FUEL5911
Atmospheric Pollution and Control (Theory)
Staff Contact: Dr JF Stubington
CP12 S1 or S2 L3
Note/s: For external students.

Causes, properties, dispersion, measurement and monitoring, control and legislation of air pollution in ambient and industrial environments.

INDC1010
Industrial Chemistry 1
Staff Contact: A/Prof MP Brungs
CP10 F L1 T1
Prerequisites: PHYS1002, MATH1032 or MATH1231 or MATH1042 or MATH1241

Introduction to the chemical industry. The role of the industrial chemist in society. The ethical responsibility of the industrial chemist. Introduction to materials for the chemical industry. Information retrieval. Communication skills. Factory visits.

Application of process calculations in chemical process operations. Conventions in methods of analysis and measurement. The chemical equation and stoichiometry. Introduction to materials balancing. Process calculations associated with gases, vapours and liquids.

INDC1020
Engineering 1 IC
Staff Contact: Dr T Pham
CP30 S1 L2 T4 S2 L3 T3

This subject is comprised of INDC1010 Industrial Chemistry 1, MECH0130 Engineering Drawing and Descriptive Geometry and MECH0330 Engineering Mechanics.

Each subject is described elsewhere in this handbook. Prospective students should note the following. It is not necessary to pass each of the three component subjects individually; however, for a student who does not pass all components separately the composite mark for the whole subject is not calculated by a simple averaging process. For a component subject in which a passing mark is not obtained, heavier weighting is applied; the lower the mark the heavier the weighting. The details of the calculation method are explained in the first week of the course. A student who is repeating the subject after failure must repeat all three components. No exemptions will be granted for components that were passed at an earlier attempt.

INDC2010
Mass and Energy Balances
Staff Contact: A/Prof M Brungs
CP5 S1 L1 T1
Prerequisites: CHEM1101 and CHEM1201, INDC1020, MATH1032 or MATH1231 or MATH1042 or MATH1241, PHYS1002

Material Balances: Revision of material balances. Problems involving bypass, recycle and purge. Problems involving staged operations. Differential material balances. Energy Balances: Thermodynamic background. First law; phase rule; reference states. General equation and its integral differential form. Open and closed systems. Application of energy balances to constant composition systems; enthalpy data; heat capacity data; phase change. Application to varying composition systems; Mixing; Heat of solution; Enthalpy concentration diagrams. Reactions. Heats of formation and combustion.

Students not taking INDC1010 will be required to complete a 28 hour bridging course offered by the School early in Session 1.

INDC2020
Introduction to Fluid Flow
Staff Contact: Dr R Amal
CP7.5 S1 L2 T1
Prerequisites: PHYS1002, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEM1101 and CHEM1201, INDC1020

Fundamental concepts of Fluids. Simplification of the Navier-Stokes Equation, continuity, Bernoullìs equation, momentum and energy equations. Flow in closed conduits, including laminar and turbulent flow, and losses due to friction. Measurement in Fluid Mechanics; viscosity, pressure, velocity, flowrate.

INDC2030
Heat Transfer and Temperature Measurement
Staff Contact: Dr R Sheikholeslami
CP5 S2 L1 T1
Prerequisites: PHYS1002, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEM1101 and CHEM1201, INDC1020

The course will deal with conduction, convection and radiation. Conduction will cover Fourierìs Law and the thermal resistance concept. Convection will deal with passage of fluid over a surface and the importance of the Reynolds number in calculating the convection heat transfer coefficient. Radiation will deal with blackbody radiation and Stefanìs Law. Applications to industrial heat transfer equipment will be discussed. Temperature measurement devices and circuits. Pyrometry.

INDC2040
Physical Process Chemistry
Staff Contact: A/Professor R Chaplin
CP15 S1 L3 T3

Definitions of Classical thermodynamics. Pressure-Volume-temperature properties of industrially important fluids. Applications of thermochemistry in industry. Conversion of heat into work. Concept of lost work. Heat engines and refrigeration cycles. General properties of solutions. Maximum conversion of reactants in batch and flow reactors. Reactor design and chemical kinetics. Reaction rates in industrial batch and flow reactors. Electrochemical principles in the context of important industrial electrochemical processes. Properties and applications of electrolytes. Industrial electrochemical processes, electrodes and cells. Surface phenomena. An integrated laboratory incorporating experiments designed to demonstrate the basic principles covered in the lecture course.

INDC3010
Thermodynamics
Staff Contact: Dr V Chen
CP7.5 S1 L2 T1
Prerequisites: CHEM2011, INDC2010

Review of first law of thermodynamics; thermochemistry; second law of thermodynamics. Auxiliary functions and conditions of equilibrium. Thermodynamic properties of fluids; thermodynamic properties of homegeneous mixtures. Chemical reaction equilibria; calculation of equilibrium compositions for single reactions. Phase equilibria; the phase rule, equilibrium.

INDC3031
Experimental Design
Staff Contact: A/Prof R Chaplin
CP7.5 S1 L2 S2 T1
Prerequisite: MATH2819

Regression analysis. Statistical design of experiments. Two level factorial designs. Screening experiments. Optimisation of process variables. Spread sheet and database utilisation. Basic programming. Industrial applications.

INDC3041
Corrosion in the Chemical Industry
Staff Contact: Prof M Skyllas-Kazacos
CP7.5 S2 L2 T1
Prerequisite: CEIC2030, CEIC2040

Selection of materials for chemical plant. Strength and corrosion resistance of less common materials of fabrication. Chemical and electrical aspects of corrosion and their application to corrosion problems encountered in the chemical process industries. Electrochemical kinetics. Design factors for corrosion prevention. Methods of corrosion prevention.

INDC3050
Chemistry of High Temperature Materials
Staff Contact: A/Prof M Brungs
CP5 S2 L2
Prerequisite: CEIC2030,CEIC2040

Chemical aspects of high temperature materials; thermodynamics and kinetics of reactions in the solid state; phase equilibria in condensed systems; gas-solid and liquid-solid reactions.

INDC3060
Unit Operations
Staff Contact: Dr A Adesina
CP5 S1 L2
Prerequisites: INDC2010, CEIC2030, CEIC2040

This course will emphasise the qualitative aspects of major unit operations in the chemical process industries. Topics covered include gas absorption, liquid-liquid extraction, distillation, filtration, evaporation, centrifugation, drying and leaching operations, particle size reduction and enlargement.

INDC3070
Instrumentation and Process Control 1
Staff Contact: A/Prof T Tran
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.

INDC3090
Chemistry of Industrial Processes
Staff Contact: Prof R Burford
CP15 F L1 T2
Prerequisite: CEIC 2030, CEIC 2040
Corequisites: CHEM2021, CHEM2839

The production of inorganic industrial chemicals from the standpoint of the application of the basic principles of inorganic and physical chemistry (acid industries, alkali industries, industrial gases electric furnace products, superphosphates, aluminum and glass); a study of some sections of the organic industrial chemical industry cellulose, industrial alcohols, formaldehyde, phenol, urea, phenolic and urea resins, acetic acid, polymers based on enthylene and acetylene, elastomers. Students are required to attend factory inspections at local and country centres as required. Laboratory: A small research project designed to illustrate practical applications of the principles of Industrial Chemistry.

INDC4040
Management
Staff Contact: A/Prof T Davis
CP5 S2 L2

A series of lectures designed to introduce the students to appropriate management techniques. Topics will include: business strategies, leadership total quality management, safety management.

INDC4060
Process Design
Staff Contact: A/Prof T Davis
CP17.5 S1 L2 T1 S2 L1 T3
Prerequisite: INDC3010, INDC3060, CEICP12010

This course will encompass the complete process design of a given (small) chemical plant. Students will be required to produce a design report which will include an environmental impact statement, plant sizing, process flow sheet, equipment selection and costing and a financial evaluation of the whole process. The report will also discuss the relevant thermodynamic and kinetic aspects of the process.

INDC4070
Laboratory Automation Science
Staff Contact: A/Prof T Tran
CP10 S1 L1.5T2.5
Prerequisite: INDC3070

The application of computers, e.g. microcomputers, to real-time data acquisition and process control in chemical laboratories and selected processes of interest to industrial chemists. Introduction to real-time digital operations and data manipulation. Organisation of a process control computer. Hardware considerations. The process computer interface. Sequential and programmable logic control of batch processes. Data acquisition and process monitoring techniques. Digital process control PID controller tuning. Graphics in process monitoring and control. Direct Digital Control.

INDC4080
Seminar
Staff Contact: Prof R Burford
CP10 F T2

Students are required to deliver two lectures on selected topics, one related to some aspect of chemical technology, and the other to their research project. The intention is to develop skill in oral expression, as well as ability in critical evaluation and logical presentation. Opportunity is taken, where appropriate, to arrange for guest lecturers.

INDC4090
Project (Industrial Chemistry)
Staff Contact: Prof R Burford
CP60 S1 T8 S2 T16

An experimental or technical investigation related to some aspect of industrial chemistry. Prerequisites and/or corequisites will be determined depending on the nature of the project.

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.

INDC4130
Environmental Chemistry of Industrial Processes
Staff Contact: Dr PT Crisp
CP5 S1 L2
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.

MINP4010
Hydrometallurgical Processes
Staff Contact: A/Prof T Tran
CP5 S1 L2

Application of principles of aqueous thermodynamics, electrochemistry, chemical and electrochemical kinetics to hydrometallurgical processes; leaching of metals, minerals and concentrates, solution purification, precipitation, and other separation processes, ion-exchange and liquid-liquid extraction, electro-winning and electro-refining. Emphasis is on processes currently used in the Australian mineral industry.

POLY0010
Polymer Materials
Staff Contact: Prof R Burford
CP15 S1 2 S2 4
Note/s: servicing subject i.e. a subject taught within courses offered by other faculties

The structure and synthesis of commercially important polymers including thermoplastics, fibres, rubbers and composites. The effect of chemical and molecular structure upon properties. Degradation. Mechanical properties including time dependent behaviour. Fabrication processes. Polymer selection for various applications.

POLY3010
Polymer Science
Staff Contact: Prof R Burford
CP15 S1 L2 S2 Lab.4
Prerequisites: CHEM2011, CHEM2021, MATH2021, MATH2819
Co or Prerequisite: INDC3090

Polymerisation chemistry and processes. Step and radical chain polymerisation. Ionic (including stereoregular) polymerisation. 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.

POLY4010
Advanced Polymer Science
Staff Contact: Prof R Burford
CP5 S1 L2
Prerequisite: POLY3010

Selected topics from basic texts and the original literature covering polymer chemistry: anionic cationic and Ziegler-Natta catalysis in polymer chemistry. Particular emphasis is placed on stereoregular polymerisation for polyolefin manufacture, stressing mechanisms and reactor configuration. The mechanism and use of metallacene based catalysts. Free radical polymerisation mechanism of homo- and copolymerisation.

POLY5000
Polymer Science
Staff Contact: Prof R Burford
CP30 F L3 T3

Polymer Processes: Classification of polymers, methods of polymerisation; bulk, solution, emulsion, suspension, high pressure; processes; step growth, chain growth; the chemistry and applications of polymer systems including polyesters, polyamides, phenolic condensation resins, vinyl polymers, synthetic elastomers. Natural polymers. Mechanism and Kinetics: Step growth polymerisation, kinetics, structure effects; chain growth polymerisation. Free radical polymerisation, chemistry and properties of free radicals and initiators; kinetics of propagation and termination reactions; co-polymerisation; monomer radical structure and reactivity. Cationic and anionic polymerisation; stereoregular polymers. Polymer Characterisation: Molecular weight; averages and distributions; thermodynamics of polymer solutions; theta temperature; fractionation methods; measurement of number-average molecular weight and weight-average molecular weight. Polymer Physics: Principles of operation of conventional polymer processing equipment; safety procedures; polymer compound design; stress strain behaviour of polymers in tension, compression, shear and flexure; elementary rheological behaviour of polymers; rubber elasticity; thermal characteristics of polymers

School of Civil and Environmental Engineering

Head of School
Professor RI Gilbert

Senior Administrative Officer
Ms KM Irvine

Executive Assistant
Dr SJ Foster

The School undertakes teaching and research in the specialist disciplines of engineering construction and management (civil engineering systems, engineering economics, project planning and management and civil engineering construction), geotechnical engineering (foundation, soil, rock, dam and pavement engineering, geomechanics and environmental geomechanics), structural engineering (structural analysis and design, concrete steel and composite structures, and concrete and materials technology), transport engineering (planning design and operation of transport systems, land use and transport modelling, statistical analysis, economic evaluations and environmental impact studies), and water engineering (hydraulics, hydrology, water resources, waste management and public health engineering).

The School comprises specialist staff with a broad spectrum of expertise across the disciplines of Civil and Environmental Engineering.

The Centre for Water and Waste Technology 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 the Department of Applied Geology in the Faculty of Science and Technology.

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.

Six-year full-time courses 4775 and 4777 leading to the award of the degrees of Bachelor of Engineering in Civil and Environmental Engineering, respectively, and Bachelor of Laws (BE LLB) are offered.

Five-year full-time combined courses 3146 leading to the award of the degrees of Bachelor of Engineering in Civil Engineering and Bachelor of Engineering in Mining Engineering (BE BE) and 3631 leading to the BE BE in Civil and Environmental Engineering are also offered.

Five-year full-time combined courses 3730 and 3735 leading to the award of the degrees of Bachelor of Engineering in Civil and Environmental Engineering respectively 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) are also offered.

The School offers the most extensive range of postgraduate coursework in Civil and Environmental Engineering in Australia. There are formal graduate courses leading to the award of the degrees of Master of Engineering Science 8612, Master of Environmental Engineering Science 8615, and also the Graduate Diploma in Engineering 5459. Corresponding courses in external mode delivery are 8617, 8618 and 5454. These courses are available in specialist areas including engineering construction and management, project management, construction management, environmental engineering, coastal engineering, geotechnical engineering, groundwater investigations and management, hydrology and water resources, 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, environmental engineering and waste management by distance learning. Fees are payable for postgraduate coursework and details are available from the School Office.

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; and 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 in each year of the course (engineering practice subjects); have been introduced to achieve this.

Honours

Honours is awarded to students who have achieved above average results. A weighted average is calculated for each student. A weighting factor for each subject by credit point value is applied as follows:

- Year 1 x 1
- General Education x 2
- Year 2 x 2
- Year 3 x 4
- Year 4 x 5

Industrial training has a nominal value of 3 session hours. For combined degree courses only the standard Civil or Environmental Engineering subject results are used in the calculation. A weighted average mark in the range of 65-70 will result in a recommendation for Honours 2/2. A weighted average mark in the range of 70-75 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 during the session breaks throughout their period of study. 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)

		HPW S1	HPW S2	CP
Year 1				
CHEM1808	Chemistry 1 CE	0	5	12.5
CVEN1011	Civil Engineering Practice 1	2	4	22.5
CVEN1015	Computing	4	0	10
CVEN1312	Statics	3	0	10
CVEN1313	Dynamics	0	2	7.5
CVEN1314	Mechanics of Solids	0	3	10
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		**115**		

		HPW S1	HPW S2	CP
Year 2				
CVEN2011	Civil Engineering Practice 2	4	4	30
CVEN2116	Engineering Construction	2	2	10
CVEN2312	Introduction to Structures	2	0	5
CVEN2313	Structural Analysis 1	0	3	7.5
CVEN2314	Engineering Materials	2	3	12.5
CVEN2515	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				
CVEN3011	Civil Engineering Practice 3	4	4	30
CVEN3015	Engineering Computations	2	2	10
CVEN3116	Engineering Management 1	2	2	10
CVEN3214	Geotechnical Engineering 1	3	3	15
CVEN3312	Structural Engineering 1	5	0	12.5
CVEN3313	Structural Engineering 2	0	5	12.5
CVEN3418	Transport Engineering 1	0	2	5
CVEN3517	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**		

		HPW S1	HPW S2	CP
Year 4				
CVEN4008	Industrial Training	0	0	0
CVEN4011	Civil Engineering Practice 4	4	4	30
CVEN4018	Honours Thesis	(3)	(3)	(15)
CVEN4116	Engineering Management 2	2	0	5
CVEN4214	Geotechnical Engineering 2	3	0	7.5
CVEN4312	Structural Engineering 3	3	0	7.5
CVEN4413	Transport Engineering 2	3	0	7.5
CVEN4515	Water Engineering 3	3	0	7.5
General Education subject		2	0	7.5
Plus two of the following five elective majors:				
CVEN4119	Construction Major	0	8	25
CVEN4219	Geotechnical Major	0	8	25
CVEN4319	Structures Major	0	8	25
CVEN4419	Transport Major	0	8	25
CVEN4519	Water Major	0	8	25
Total HPW Session 1		**20 (3)**		
Total HPW Session 2		**20 (3)**		
Total Credit Points1		**122.5 (137.5)**		

3625
Environmental Engineering – Full-time Course

BE (Environmental)

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
CVEN1015	Computing	0	4	10
CVEN1312	Statics	3	0	10
CVEN1710	Environmental Engineering Practice 1	3	3	22.5
GEOG1721	Planet Earth: Environment in Crisis	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		**130**		

Year 2				
BIOS1101	Evolutionary and Functional Biology	0	6	15
CEIC0010	Mass Transfer and Materials Balance	2	2	10
CVEN2321	Engineering Mechanics and Materials	3	3	15
CVEN2515	Water Engineering 1	0	3	7.5
CVEN2710	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**		

Year 3				
BIOS3301	Population and Community Ecology for Environmental Engineers	0	3	7.5
CEIC0050	Atmospheric and Process Chemistry	3	0	7.5
CVEN3015	Engineering Computations	2	2	10
CVEN3116	Engineering Management 1	2	2	10
CVEN3214	Geotechnical Engineering 1	3	3	15
CVEN3428	Transport and Noise Engineering	1	2	7.5
CVEN3517	Water Engineering 2	3	3	15
CVEN3521	Principles of Aquatic Chemistry	0	3	7.5
CVEN3710	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**		

Year 4				
CEIC0040	Unit Operations in the Process Industries	2	2	10
CVEN4522	Environmental Water Engineering	3	2	12.5
CVEN4523	Transport and Fate of Pollutants in Coastal and Groundwater Environments	3	0	7.5
CVEN4710	Environmental Engineering Practice 4	4	4	30
CVEN4717	Industrial Training	0	0	0
CVEN4718	Honours Thesis	(3)	(3)	(15)
CVEN4720	Waste Management and Site Remediation	3	0	7.5
CVEN4730	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	20
CVEN4229	Geotechnical Major – Environmental	0	6	20
CVEN4429	Transport Major – Environmental	0	6	20
CVEN4529	Water Major – Environmental	0	6	20

Geography major consisting of approved Geography subjects

Total HPW Session 1	**21 (3)**
Total HPW Session 2	**20 (3)**
Total Credit Points	**122.5 (137.5)**

Combined Courses

Programs for combined degree courses offered in the School of Civil and Environmental Engineering are listed below.

3621
BE BA in Civil Engineering – Full-time Course

With this combined degree course, students can add their choice of an Arts program to the standard, professionally accredited Civil Engineering course offered by the School of Civil and Environmental 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 Civil Engineering.

Because Engineering and Arts programs can have a common content, such as mathematics and physics, approximately three additional sessions of study is normally required to gain the additional qualification of Bachelor of Arts. In general, this additional study is taken concurrently with the BE program and both can be completed in ten sessions.

Eligibility

The course is open to all students who satisfy both the Civil Engineering and Arts entry conditions. Students may enter directly in Year 1 or may apply to transfer from the normal engineering course after completion of at least one year if they have a credit or higher average or the permission of the Head of School. Transfer after the second year may result in students taking more than minimum time to complete the combined course.

Organisation

The BE BA course is administered by the School of Civil and Environmental Engineering. The School requires the student to obtain the approval of the Faculty of Arts and Social Sciences for the BA components of their course. The final program and timetable must be approved by the School of Civil and Environmental Engineering.

Student should start discussing their program with representatives of the School and the Faculty of Arts and Social Sciences as early as possible. Students should themselves determine the Arts program that they wish to undertake. The Arts and Social Sciences Handbook describes the options. There are no special rules on what subjects should be included in each year. Students should schedule the Arts and Engineering components to suit their preferences, while meeting the constraints of timetables and prerequisites.

Students will need to refer to the current edition of the Faculty of Arts and Social Sciences Handbook.

Rules

1. Students must complete 150 credit points in the BA course, with no more than 60 credit points obtained at Level 1 (ie in subjects designed for students in their fist year of study). Of these 60 Level 1 credit points, no more than 30 credit points may be from any one School or Department.
2. Students must complete a major sequence (105cp) in one of the following areas :

   Chinese
   English
   Environmental Studies *
   French
   German Studies
   Greek, Modern
   History
   Indonesian
   Japanese**
   Linguistics
   Music
   Philosophy
   Political Science
   Policy Studies
   Russian Studies
   Science & Technology Studies
   Sociology
   Spanish & Latin American Studies
   Theatre & Film Studies

   * Students completing an Environmental Studies major sequence must complete, in addition to the 75 Upper Level credit points specified, 15 Level 1 credit points in an approved subject. Students must also complete a minor sequence of 45 credit points in one of the other areas (excluding Japanese) listed in the table above.

   ** Students completing a Japanese major sequence must also complete a minor sequence of 45 credit points in one of the other areas (excluding Environmental Studies) listed in the table above.
3. Except for subjects completed as part of the Environmental Studies or Japanese major sequences, no more than 30 credit points may be obtained **from** subjects in the BA course which are offered by Schools outside the Faculty of Arts and Social Sciences.
4. No subject included for credit in the BE program can be included in 150 credit points required at Rule 1 for the BA program.
5. Students must complete the full requirements of Course 3620 BE in Civil Engineering except that :
   (a) only one major is required in Year 4 and must be chosen from

   CVEN4119 Construction Major
   CVEN4219 Geotechnical Major
   CVEN4319 Structures Major
   CVEN4419 Transport Major
   CVEN4519 Water Major

(b) Students are not required to complete CVEN4018 Honours Thesis (However, BE/BA students will still be considered for honours).

6. The General Education requirement will be satisfied by completing 15 credit points of General Education.
7. Students may be awarded Honours in the BA by successful completion of honours year. It should be noted that entry into a particular BA Honours program may require completion of subjects additional to those specified under Rules 1-4.
8. **Credit Points**

Year 1	115
Year 2	122.5
Year 3	125
Year 4	120
Year 5	105

3626
BE BA in Environmental Engineering – Full-time Course

With this combined degree course, students can add their choice of an Arts program to the standard, professionally accredited Environmental Engineering course offered by the School of Civil and Environmental 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 Environmental Engineering.

Because Engineering and Arts programs can have a common content, such as mathematics and physics, approximately three additional sessions of study is normally required to gain the additional qualification of Bachelor of Arts. In general, this additional study is taken concurrently with the BE program and both can be completed in ten sessions.

Eligibility

The course is open to all students who satisfy both the Environmental Engineering and Arts entry conditions. Students may enter directly in Year 1 or may apply to transfer from the normal engineering course after completion of at least one year if they have a credit or higher average or the permission of the Head of School. Transfer after the second year may result in students taking more than minimum time to complete the combined course.

Organisation

The BE BA course is administered by the School of Civil and Environmental Engineering. The School requires the student to obtain the approval of the Faculty of Arts and Social Sciences for the BA components of their course. The final program and timetable must be approved by the School of Civil and Environmental Engineering.

Students should start discussing their program with representatives of the School and the Faculty of Arts and Social Sciences as early as possible. Students should themselves determine the Arts program that they wish to undertake. The Arts and Social Sciences Handbook describes the options. There are no special rules on what subjects should be included in each year. Students should schedule the Arts and Engineering components to suit their preferences, while meeting the constraints of timetables and prerequisites.

Students will need to refer to the current edition of the Faculty of Arts and Social Sciences Handbook.

Rules

1. Students must complete 150 credit points in the BA course, with no more than 60 credit points obtained at Level 1 (ie in subjects designed for students in their first year of study). Of these 60 Level 1 credit points, no more than 30 credit points may be from any one School or Department.
2. Students must complete a major sequence (105cp) in one of the following areas :

   Chinese
   English
   Environmental Studies *
   French
   German Studies
   Greek, Modern
   History
   Indonesian
   Japanese**
   Linguistics
   Music
   Philosophy
   Political Science
   Policy Studies
   Russian Studies
   Science & Technology Studies
   Sociology
   Spanish & Latin American Studies
   Theatre & Film Studies

   * Students completing an Environmental Studies major sequence must complete, in addition to the 75 Upper Level credit points specified, 15 Level 1 credit points in an approved subject. Students must also complete a minor sequence of 45 credit points in one of the other areas (excluding Japanese) listed in the table above.

   ** Students completing a Japanese major sequence must also complete a minor sequence of 45 credit points in one of the other areas (excluding Environmental Studies) listed in the table above.

3. Except for subjects completed as part of the Environmental Studies or Japanese major sequences, no more than 30 credit points may be obtained from subjects in the BA course which are offered by Schools outside the Faculty of Arts and Social Sciences.

4. No subject included for credit in the BE program can be included in 150 credit points required at Rule 1 for the BA program.
5. Students must complete the full requirements of Course 3625 BE in Environmental Engineering except that :
   a) only one major is required in Year 4 and must be chosen from

      CVEN4229 Geotechnical Major – Environmental
      CVEN4429 Transport Major – Environmental and
      CVEN4529 Water Major – Environmental

   b) Students are not required to complete CVEN4718 Honours Thesis (However, BE/BA students will still be considered for honours).
6. The General Education will be satisfied by completing 15 credit points of General Education.
7. Students may be awarded Honours in the BA by successful completion of honours year. It should be noted that entry into a particular BA Honours program may require completion of subjects additional to those specified under Rules 1-4.
8. **Credit Points**

Year 1	130
Year 2	120
Year 3	125
Year 4	127.5
Year 5	105

3730
BE BSc in Civil Engineering – Full-time Course

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

With the combined degree course, students can add their choice of a Science and Mathematics course to the standard, professionally accredited Civil Engineering course offered by the School of Civil and Environmental Engineering.

Subject credits can accrue simultaneously for both component degrees where there is an overlap of subjects from the Civil Engineering course and Science and Mathematics course.

Rules

1. The course is a five year full-time combined course leading to the award of the two degrees of Bachelor of Engineering and Bachelor of Science (BE BSc).
2. The five years of the course include at least 270 credit points in the Science course (course code 3970).
3. The 270 Science course credit points must include a minimum of 90 and a maximum of 120 level 1 credit points and all subjects prescribed in a specific program as outlined in the Science Handbook must be completed.
4. Students must satisfy the normal prerequisites for entry to the Board of Studies in Science and Mathematics and to individual subjects therein. Also, students must satisfy the normal prerequisites for entry to Civil Engineering and to individual subjects therein.
5. Students desiring to enrol in the BSc degree course at Honours level are not able to complete the course in five years and must obtain approval from the School of Civil and Environmental Engineering and the Board of Studies in Science and Mathematics for their programs. With the approval of the relevant school and of the Head of the School of Civil and Environmental Engineering, a student may follow a standard Honours program in the Science course which can be completed by an additional year of study.
6. The degree of Bachelor of Science is not awarded until the completion of the full five year program.
7. Students contemplating enrolling in this course should consult fully with the Board of Studies in Science and Mathematics and with the School of Civil and Environmental Engineering before enrolment.
8. There will be a testamur for each degree in the combined course.
9. Students must complete the full requirements of the BE in Civil Engineering (course code 3620) except that:
   a) Only one major is required.
   b) Students will be considered for honours without CVEN4018 Honours Thesis.
10. Thirty credit points (112 hours) of General Education will satisfy the course General Education requirements
11. Group A and Group B subjects below will count towards satisfying requirements of both rules 2 and 9 above. The subjects in Group B may not satisfy requirements for progression within science programs.
12. Students may apply for exemption from the requirements of Rule 9 for the subjects listed below in Group B on the basis of subjects/requirements in parentheses.
13. Exemptions will be granted for the subjects in Group C below with respect to Rule 9 on the basis of the requirements within parentheses.

Group A

MATH1131 or MATH1141, MATH1231 or MATH1241

Group B

PHYS1979 (PHYS1002), CHEM1808 (CHEM1101 and CHEM1201), MATH2009 (at least 30 credit points of non statistics level II mathematics), MATH2869 (at least 10 credit points of level II Statistics).

Group C

CVEN3015 (at least 10 credit points level III applied mathematics).

A typical structure of a combined Engineering /Science course is set out below. Subject to timetable restrictions, the full range of Science programs is available to Civil Engineering students.

Year 1

Complete year 1 program of the Civil Engineering course and 15 credit points of Science subjects.

Year 2

Complete year 2 program of the Civil Engineering course.

Year 3

Science subjects to total at least 75 credit points.

CVEN3015, CVEN3214, CVEN3312, CVEN3313, CVEN3418.

Year 4

Science subjects to total at least 75 credit points

CVEN3011, CVEN3116, CVEN3517.

Year 5

Science subjects to total at least 30 credit points.

CVEN4008, CVEN4011, CVEN4116, CVEN4214, CVEN4312, CVEN4413, CVEN4515 plus one of CVEN4119, CVEN4219,CVEN4319, CVEN4419 and CVEN4519.

Note: additional credit points may be required in Science depending on which program is being completed.

14.Credit Points

Year 1	130
Year 2	122.5
Year 3	130
Year 4	130
Year 5	120

3735
BE BSc in Environmental Engineering – Full-time Course

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

With the combined degree course, students can add their choice of a Science and Mathematics course to the standard, professionally accredited Environmental Engineering course offered by the School of Civil and Environmental Engineering.

The School of Civil and Environmental Engineering is the academic unit responsible for the course. The School will consult with the Board of Studies of Science and Mathematics in approving the BSc component of the course.

Students must satisfy admission requirements for both the BE in Environmental Engineering and BSc courses, or may transfer from the BE in Environmental Engineering course after completion of at least one year if they have a credit or higher average or the permission of the Head, School of Civil and Environmental Engineering.

Subject credits can accrued simultaneously for both component degrees where there is an overlap of subjects from the Environmental Engineering course and Science and Mathematics course.

Rules

1. The course is a five year full-time combined course leading to the award of the two degrees of Bachelor of Engineering and Bachelor of Science (BE BSc).
2. The five years of the course include at least 270 credit points in the Science course (course code 3970).
3. The 270 Science course credit points must include a minimum of 90 and a maximum of 120 level 1 credit points and all subjects prescribed in a specific program as outlined in the Science Handbook must be completed.
4. Students must satisfy the normal prerequisites for entry to the Board of Studies in Science and Mathematics and to individual subjects therein. Also, students must satisfy the normal prerequisites for entry to the Civil Engineering and to individual subjects therein.
5. Students desiring to enrol in the BSc degree course at Honours level are not able to complete the course in five years and must obtain approval from the School of Civil and Environmental Engineering and the Board of Studies in Science and Mathematics for their programs. With the approval of the relevant school and of the Head of the School of Civil and Environmental Engineering, a student may follow a standard Honours program in the Science course which can be completed by an additional year of study.
6. The degree of Bachelor of Science is not awarded until the completion of the full five year program.
7. Students contemplating enrolling in this course should consult fully with the Board of Studies in Science and Mathematics and with the School of Civil and Environmental Engineering before enrolment.
8. There will be a testamur for each degree in the combined course.
9. Students must complete the full requirements of the BE in Environmental Engineering (course code 3625) except that :
   a) Only one major is required and must be chosen from:

      CVEN4229 Geotechnical Major – Environmental
      CVEN4429 Transport Major – Environmental
      and
      CVEN4529 Water Major – Environmental

   b) Students will be considered for honours without CVEN4718 Honours Thesis.

10. Thirty credit points (112 hours) of General Education will satisfy the course General Education requirements.
11. Group A and Group B subjects below will count towards satisfying requirements of both rules 2 and 9 above. The subjects in Group B may not satisfy requirements for progression within science programs.
12. Students may apply for exemption from the requirements of Rule 9 for the subjects listed below in Group B on the basis of subjects/requirements in parentheses.
13. Exemptions will be granted for the subjects in Group C below with respect to Rule 9 on the basis of the requirements within parentheses.

Group A

CHEM1101, CHEM1201, MATH1131, *or* MATH1141, MATH11231 *or* MATH1241, BIOS1101

Group B

PHYS1979 (PHYS1002), MATH2019 (at least 30 credit points of non statistics level II mathematics), MATH2869 (at least 10 credit points to level II Statistics), GEOG1721 (GEOG1073), BIOS3301 (BIOS3111).

Group C

CVEN3015 (at least 10 credit points level III applied mathematics).

A typical structure of a combined Engineering/Science course is set out below. Subject to timetable restrictions, the full range of Science programs is available to Environmental Engineering students.

Year 1

Complete year 1 program of the Environmental Engineering course.

Year 2

Complete year 2 program of the Environmental Engineering course.

Year 3

Science subjects to total at least 60 credit points

CVEN3015, CVEN3116, CVEN3214, CVEN3428, CVEN3517

Year 4

Science subjects to total at least 60 credit points

CVEN3521, CVEN3710, BIOS3301, CEIC0050

Year 5

Science subjects to total at least 25 credit points

CEIC0040, CVEN4522, CVEN4523, CVEN4710, CVEN4717, CVEN4720, CVEN4730, GMAT0753 plus one of CVEN4229, CVEN4429 and CVEN4529

Note: additional credit points may be required in Science depending on which program is being completed.

The degrees of Bachelor of Engineering and Bachelor of Science may be conferred as a Pass degree or as an Honours degree. There are two classes of Honours, Class 1 and Class 2 in two divisions. The award and grade of honours in the BE are made in recognition of superior performance throughout the course with a greater weighting on subjects in the later years. The BSc can be awarded honours on the successful completion of an honours years. It should be noted that entry into a particular Honours program may require completion of additional subjects.

15. **Credit Points**

Year 1	130
Year 2	120
Year 3	117.5
Year 4	120
Year 5	127.5

3631
BE in Civil Engineering
BE in Environmental Engineering

The course will provide students with professional qualifications in areas of great importance to the community. The course will prove attractive to students who have in mind a career involving environmental issues and infrastructure development. The course is administered by the School of Civil and Environmental Engineering.

Rules

1. Students must satisfy the normal course and subject prerequisites for Environmental Engineering and Civil Engineering.
2. **Course Outline**

Year 1

Standard Year 1 of Course 3620

Year 2

Standard Year 2 of Course 3620

Year 3		**CP**
BIOS1101	Evolutionary and Functional Biology	15
CHEM1101*	Chemistry 1A`	15
CHEM1201	Chemistry 1B	15
CVEN3015	Engineering Computations	10
CVEN3116	Engineering Management	10
CVEN3214	Geotechnical Engineering 1	15
CVEN3428	Transport and Noise Engineering	7.5
CVEN3517	Water Engineering 2	15

CVEN3521	Principles of Aquatic Chemistry	7.5
CVEN3710	Environmental Engineering Practice 3	30
	Total credit points	**140**

** Students will be exempted from CHEM1101 if they have obtained a DN or HD in CHEM1808.*

Year 4		**CP**
BIOS3310	Population and Community Ecology for Environmental Engineers	7.5
CEIC0010	Mass Transfer and Materials Balance	10
CEIC0050	Atmospheric and Process Chemistry	7.5
GEOG1721	Planet Earth: Environment in Crisis	10
INDC4120	Chemistry of the Industrial Environment	7.5
CVEN3312	Structural Engineering 1	12.5
CVEN3313	Structural Engineering 2	12.5
CVEN4214	Geotechnical Engineering 2	12.5
CVEN4413	Transport Engineering 2	12.5
Plus one elective major		25
General Education subjects		15
	Total credit points	**132.5**

Year 5		**CP**
CEIC0040	Unit Operations in the Process Industries	10
CVEN4312	Structural Engineering 3	7.5
CVEN4522	Environmental Water Engineering	12.5
CVEN4523	Transport and Fate of Pollutants in Coastal and Groundwater Environments	7.5
CVEN4710	Environmental Engineering Practice 4	30
CVEN4717	Industrial Training	0
CVEN4720	Waste Management and Site Remediation	7.5
CVEN4730	Environmental Management	10
GMAT0753	Introduction to Spatial Information Systems	5
Plus two elective majors		40(50)
Approved Geography subjects		
	Total credit points	**140**

3. Students do not have to complete a thesis to be considered for honours in engineering.
4. The degrees of Bachelor of Engineering may be conferred as Pass or Honours degrees. There are two classes of Honours, Class 1, and Class 2, in two divisions. The award and grade of Honours are made in recognition of superior performance throughout the course with a greater weighting on subjects in the later years. The course can lead to the award of the University Medal.
5. Thirty credit points (112 hours) of General Education will satisfy the course General Education requirements.
6. There will be a testamur for each degree in the combined course.
7. Students must satisfy admission requirements for the BE in Environmental Engineering for direct admission or may transfer from the BE in Civil Engineering course after completion of the first two years with a weighted average mark of 65 or greater or with the permission of the Head of School of Civil and Environmental Engineering.
8. **Credit Points**

Year 1	107.5
Year 2	122.5
Year 3	140
Year 4	127.5
Year 5	130

3146
BE in Civil Engineering BE in 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 and Environmental Engineering. The first three years of the combined degree course are therefore identical to course 3620. After completing 6 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 Mining Engineering and aim to complete the mining requirements in 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 will provide students with professional qualifications in areas of very great importance to the community. The course will prove attractive to students who have in mind a career involving construction or general engineering. Most large developments raise a formidable range of legal issues, and there appears to be a need for highly qualified personnel who are able to understand both the engineering and the legal dimensions of development, both in Australia and overseas.

This course is administered by the Faculty of Law and candidates are admitted through the Faculty of Law.

Rules

1. The course is six year full-time combined course leading to the award of the two degrees of Bachelor of Engineering and Bachelor of Laws (BE LLB).
2. Students must satisfy the normal prerequisites for entry to the Faculty of Engineering and to individual subjects in that faculty. Students must study engineering subjects in a sequence approved by the Faculty of Engineering. There are no general Faculty prerequisites to courses offered by the Faculty of Law but students must study law subjects in a sequence approved by the Faculty of Law.
3. The total of credit points required in law subjects is 400 (240 from compulsory subjects and 160 from elective subjects).
4. The subjects listed below are required to complete the course, these are set out in a typical yearly program.

Year 1		**CP**
PHYS1979	Physics I CE	12.5
CHEM1808	Chemistry 1 CE	12.5
CVEN1015	Computing	10
CVEN1312	Statics	10
CVEN1313	Dynamics	7.5
CVEN1314	Mechanics of Solids	10
CVEN1011	Civil Engineering Practice 1	22.5
MATH1131	Mathematics 1A	
or MATH1141		15
MATH1231	Mathematics 1B	
or MATH1241		15
General Education Subjects*		15
	Total credit points	**130**

** Students may wish to consider summer session general education subjects or deferring these until later years.*

Year 2		**CP**
CVEN2011	Civil Engineering Practice 2	30
CVEN2116	Engineering Construction	10
CVEN2312	Introduction to Structures	5
CVEN2313	Structural Analysis	7.5
CVEN2314	Engineering Materials	12.5
CVEN2515	Water Engineering 1	7.5
GMAT0442	Surveying for Civil Engineers	7.5
GMAT0491	Survey Camp	7.5
LAWS1120	Legal System Torts	30
LAWS7410	Legal Research and Writing 1	10
MATH2019	Engineering Mathematics 2CE	15
MATH2869	Applied Statistics SC	5
	Total credit points	**147.5**

Year 3		**CP**
CVEN3011	Civil Engineering Practice 3	30
CVEN3015	Engineering Computations	10
CVEN3116	Engineering Management 1	10
CVEN3214	Geotechnical Engineering 1	15
CVEN3312	Structural Engineering 1	12.5
CVEN3313	Structural Engineering 2	12.5
CVEN3418	Transport Engineering 1	5
CVEN3517	Water Engineering 2	15
LAWS1420	Contracts	22.5
LAWS2140	Public Law	7.5
LAWS7420	Legal Research and Writing 2	5
	Total credit points	**145**

Year 4		**CP**
CVEN4008	Industrial Training	0
CVEN4214	Geotechnical Engineering 2	7.5
CVEN4312	Structural Engineering 3	7.5
CVEN4413	Transport Engineering 2	7.5
CVEN4515	Water Engineering 3	7.5
LAWS1610	Criminal Law	30
LAWS2160	Administrative Law	15
LAWS3010	Property and Equity	30
LAWS2361	Environmental Law	15

Plus one of the following five elective majors :

CVEN4119	Construction Major	25
CVEN4219	Geotechnical Major	25
CVEN4319	Structures Major	25
CVEN4419	Transport Major	25
CVEN4519	Water Major	25
	Total credit points	**145**

Note: students do not have to complete a thesis to be considered for honours in engineering.

Year 5		**CP**
CVEN4011	Civil Engineering Practice 4	30
LAWS1010	Litigation	30
LAWS8320	Legal Theory	15
or LAWS8820	Law and Social Theory	15
LAWS4010	Business Associations 1	15
LAWS2150	Federal Constitutional Law	15
LAWS6210	Law, Lawyers and Society	15
LAWS7430	Research Component	0.5

Law electives to the value of 20 credit points

Total credit points 150

Year 6

Law electives to the value of 120 credit points

5. The degree of Bachelor of Engineering may be conferred as a Pass degree or as an Honours degree.

   There are two classes of Honours, Class I, Class II in two divisions. The award and grade of Honours are made in recognition of superior performance throughout the course with a greater weighting on subjects in the later years.

6. **Credit Points**

Year 1	130
Year 2	147.5
Year 3	145
Year 4	150
Year 5	135

4777
BE LLB in Environmental Engineering and Law – Full-time Course

This course will provide students with professional qualifications in areas of very great importance to the community. The course will prove attractive to students who have in mind a career involving environmental issues or engineering. Most large developments raise a formidable range of legal issues, and there is a need for highly qualified personnel who are able to understand both the engineering and the legal dimensions of development, both in Australia and overseas.

This course is administered by the Faculty of Law and candidates are admitted through the Faculty of Law.

Rules

1. The course is a six year full-time combined course leading to the award of the two degrees of Bachelor of Engineering and Bachelor of Laws (BE LLB).
2. Students must satisfy the normal prerequisites for entry to the Faculty of Engineering and to individual subjects in that faculty. Students must study engineering subjects in a sequence approved by the Faculty of Engineering. There are no general Faculty prerequisites to courses offered by he Faculty of Law but students must study law subjects in a sequence approved by the Faculty of Law.
3. The total of credit points required in law subjects is 405 (240 from compulsory subjects and 165 from elective subjects).
4. The subjects listed below are required to complete the course, these are set out in a typical yearly program.

Year 1		**CP**
CVEN1015	Computing	10
CVEN1312	Statics	10
CVEN1710	Environmental Engineering Practice 1	22.5
CHEM1101	Chemistry 1A	15
CHEM1201	Chemistry 1B	15
GEOG1721	Planet Earth: The Environment in Crisis	10
MATH1131	Mathematics 1A	
or MATH1141	Higher Mathematics 1A	15
MATH1231	Mathematics 1B	
or MATH1241	Higher Mathematics 1B	15
PHYS1979	Physics 1CE	12.5
General Education subjects*		15
	Total credit points	**140**

**Students may wish to consider summer session general education subjects or deferring these till later years.*

Year 2		**CP**
BIOS1101	Functional & Evolutionary Biology	15
CEIC0010	Mass Transfer and Materials Balance	10
CVEN2321	Engineering Mechanics and Materials	15
CVEN2515	Water Engineering 1	7.5
CVEN2710	Environmental Engineering Practice 2	30
INDC4120	Chemistry of the Industrial Environment	7.5
MATH2019	Engineering Mathematics 2CE	15
MATH2869	Applied Statistics SC	5
LAWS1120	Legal Systems Torts	30
LAWS7410	Legal Research and Writing 1	10
	Total credit points	**145**

Year 3		**CP**
BIOS3310	Population and Community Ecology for Environmental Engineers	7.5
CEIC0050	Atmospheric and Process Chemistry	7.5
CVEN3015	Engineering Computations	10
CVEN3116	Engineering Management	10
CVEN3214	Geotechnical Engineering 1	15
CVEN3428	Transport and Noise Engineering	7.5
CVEN3517	Water Engineering 2	15
CVEN3521	Principles of Aquatic Chemistry	7.5
CVEN3710	Environmental Engineering Practice 3	30
LAWS1420	Contracts	22.5
LAWS2140	Public Law	7.5
LAWS7420	Legal Research and Writing 2	5
	Total credit points	**127.5**

Year 4		**CP**
CEIC0040	Unit Operations in the Process Industries	10
CVEN4522	Environmental Water Engineering	12.5
CVEN4717	Industrial Training	0
LAWS1610	Criminal Law	30
LAWS2160	Administrative Law	15
LAWS3010	Property and Equity	30
LAWS3410	Environmental Law	15

Plus at least 15 credit points from the following:

CVEN4523	Transport and Fate of Pollutants in Coastal and Groundwater Environments	7.5
CVEN4720	Waste Management and Site Remediation	7.5
CVEN4730	Environmental Management	10
GMAT0753	Introduction to Spatial Information Systems	5

Plus one of 3 of the following electives

CVEN4229	Geotechnical Major – Environmental	25
CVEN4429	Transport Major – Environmental	25
CVEN4529	Water Major – Environmental	25

Total credit points 152.5

Note: students do not have to complete a thesis to be considered for honours in engineering.

Year 5		**CP**
CVEN4710	Environmental Engineering Practice 4	30
LAWS1010	Litigation	30
LAWS8320	Legal Theory	15
or		
LAWS8820	Law and Social Theory	15
LAWS4010	Business Associations 1	15
LAWS2150	Federal Constitutional Law	15
LAWS6210	Law, Lawyers and Society	15
LAWS7430	Research Component	0

Law electives to the value of 15 credit points

Total credit points 135

Year 6
Law electives to the value of 135 credit points

5. The degrees of Bachelor of Engineering may be conferred as a Pass degree or as Honours degree.

   There are two classes of Honours, Class I, and Class II in two divisions. The award and grade of Honours are made in recognition of superior performance throughout the course with a greater weighting on subjects in the later years.
6. Fifteen credit points (56 hours) of General Education will satisfy the course General Education requirements.
7. There will be a testamur for each degree in the combined course.

BE/MCom Bachelor of Engineering/Master of Commerce

The Bachelor of Engineering/Master of Commerce concurrent programs allow students to complete BE and MCom degrees. These courses provide professional qualifications in engineering and business/commerce. They are suited to high ability students who have technological flair and a desire to work with, and manage teams of professionals, projects and business.

Program of Study

Students undertake the first three years of their BE program. In Year 4 they undertake 3 core Master of Commerce (MCom) subjects which, along with a further exemption based on the high level of mathematics and statistics in their BE degrees, lead to advanced standing of 4 MCom subjects.

To complete the remaining 8 MCom subjects, students can choose either full-time study or defer until a later date retaining credit for the 4 MCom subjects.

Eligibility and Application

A minimum of a 65% average in the first 3 years of the BE program is required. Students should apply at the end of Year 3 to undertake the MCom subjects in Year 4. Normal HECS/fees applies for the 4 years of the undergraduate degree including the MCom subjects in Year 4. However, course fees apply to the 8 remaining MCom subjects.

Postgraduate Study

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 a wide range of areas.

Students may also undertake in external mode the Master of Engineering Science 8617, the Master of Environmental Engineering Science 8618 and Graduate Diploma 5454 courses, and specialise in engineering construction and management or aspects of water engineering. Fees are payable for these external courses.

The School also offers a certificate qualification on completion of 60credit points. For further details please see page 80.

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 30 credit point project. Subjects are presented in a range of delivery modes including 3 hours per week over a 14 week session (15 cp), 3 hours per week over a 7 week period (7.5 cp), and as 3 day short courses. Subject to approval candidates may undertake some subjects from other schools in the faculty, in other faculties or at other universities.

Students may enrol in a particular program or specialisation. Usually a student completes the core requirements in the specialisation, and then a choice of elective subjects and/or a project. Elective subjects must be approved by the course coordinator.

Graduate Diploma candidates are required to complete a program of study totalling 90 credit points of coursework and may choose from a range of subjects in the discipline of their choice, perhaps including all the core subjects of one of the specialisations. 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 up to 45 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 Office.

8612
Master of Engineering Science
MEngSc

Internal Mode Delivery

Subjects are offered in a range of credit point values and delivery modes. Note that not all subjects are offered each year and the School Office should be consulted for details of which subjects are offered in any particular year.

8612.1000 Engineering Construction and Management
8612.1100 Project Management
8612.1200 Construction Management
8613.1300 Engineering/Technology Management

Subjects are selected from the following list:

Management

CVEN9701	Engineering Economics and Financial Management
CVEN9702	Project Planning and Control
CVEN9703	Quality and Quality Systems
CVEN9706	Human Resources Management
CVEN9707	Contracts Management
CVEN9708	Asset Management
CVEN9710	Management of Risk
CVEN9711	Management of Professional Services
CVEN9714	Resource Management
CVEN9717	Marketing in Technology and Engineering
CVEN9718	Strategic Management in Engineering
CVEN9720	Problem Solving and Decision Making
CVEN9726	Legal Studies and Professional Practice
CVEN9730	International Project Management
CVEN9731	Project Management Framework

Construction

CVEN9723	Design of Construction Operations
CVEN9724	Construction Engineering and Technology
CVEN9727	Construction Estimating and Tendering

8612.2000 Geotechnical Engineering

Specialist areas include geotechnical engineering and pavement engineering. Subjects are selected from the following list:

CVEN9770	Introduction to Numerical Methods in Civil Engineering
CVEN9775	Numerical Methods in Geotechnical Engineering
CVEN9776	Engineering for Underground Structures
CVEN9779	Soil Dynamics and Earthquake Engineering
CVEN9783	Pavement Materials
CVEN9784	Pavement Analysis and Design
CVEN9785	Pavement Evaluation and Management
CVEN9786	Industrial, Airport and Heavy Duty Pavements
CVEN9788	Geotechnical Site Investigations
CVEN9790	Soil and Rock Slope Instability and Stabilisation
CVEN9792	Foundation Engineering
CVEN9799	Geotechnics of Waste Disposal and Site Remediation

8612.3000 Structural Engineering

Subjects are selected from the following lists:

CVEN9772	Numerical Methods in Civil Engineering
CVEN9802	Structural Stability
CVEN9804	Vibration of Structures
CVEN9806	Prestressed Concrete Design
CVEN9809	Reinforced Concrete Design
CVEN9814	Analysis of Plates and Shells
CVEN9818	Bridge Engineering
CVEN9820	Computational Structural Mechanics
CVEN9822	Steel Structures
CVEN9824	Advanced Materials Technology
CVEN9825	Continuum Mechanics

8612.4000 Transport Engineering

Subjects are selected from the following list or from other subjects approved by course coordinator:

CVEN9403	Theory of Land Use Transport Interaction
CVEN9405	Urban Transport Planning Practice
CVEN9407	Transport Systems Design (Non-Urban)
CVEN9408	Transport Systems Design (Urban)
CVEN9410	Highway Engineering Practice
CVEN9414	Transport Systems Part 1
CVEN9415	Transport Systems Part 2
CVEN9418	Transport and Social Impact Assessment
CVEN9420	Special Topic in Transport Engineering
CVEN9421	Fundamentals of Traffic Engineering
CVEN9422	Traffic Management and Control
CVEN9423	Transport Environmental Analysis, Assessment and Control
SAFE9544	Traffic Safety

8612.5000 Water Engineering

In addition to the specialisations listed below, a more general MEngSc program in Water Engineering can be undertaken by choosing 120 credit points from any of the core areas shown below or the list of additional elective subjects.

Specialisation in Water Engineering is possible in the following six areas by completing the core subjects:

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

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

Specialisation Area Core Subject Requirements

8612.5100 Waste Management

The subjects in this 75 credit point core are all offered over a 14 week period, and are each worth 15 credit points. The remaining 45 credit points can be made up from a 30 credit point project and electives as approved by the course coordinator.

CVEN9851	Unit Operations in Public Health Engineering
CVEN9872	Solid Waste Management
CVEN9881	Hazardous Waste Management
CVEN9884	Environmental Engineering Science 1
CVEN9885	Environmental Engineering Science 2

8612.5200 Water and Wastewater Treatment

The subjects in this 75 credit point core are all offered over a 14 week period, and are each worth 15 credit points. The remaining 45 credit points can be made up from a 30 credit point project and electives as approved by the course coordinator.

CVEN9851	Unit Operations in Public Health Engineering
CVEN9884	Environmental Engineering Science 1
CVEN9855	Water and Wastewater Analysis
CVEN9856	Water Treatment
CVEN9857	Wastewater Treatment

Additional Elective Subjects

GEOL9055	Hydrogeochemical Modelling
CVEN7817	Water in Mining Engineering
CVEN7829	Decision Support Systems
CVEN7822	Water Resources Modelling 2

8612.5300 Groundwater Studies

All subjects in this 90 credit point core are 7.5 credit point subjects offered in 3-day short course mode. GEOL subjects are offered in co-operation with the School of

Geology. The program is organised by the UNSW Groundwater Centre. The remaining 30 credit points may be from a 30 credit point project, or any combination of other subjects available within the School. Elective subjects from other faculties can be taken with the approval of the course coordinator.

CVEN7807	Groundwater Hydrology
CVEN7808	Investigation of Groundwater Resources
CVEN7809	Geophysical Techniques in Groundwater Studies
CVEN7819	Hydrological Processes
CVEN7823	Applied Groundwater Modelling
CVEN7825	Aquatic Chemistry for Engineering
CVEN7830	Physical Aspects of Contaminated Groundwater
CVEN7831	Chemical and Biological Aspects of Contaminated Groundwater
GEOL9111	Groundwater Environments
GEOL9112	Investigation and Management of Salinity
GEOL9053	Hydrogeochemistry
GEOL9054	Analysis and Interpretation of Hydrochemical Data

8612.5400 Coastal Engineering and Management

All subjects in this 90 credit point core are 7.5 credit point subjects offered in 3-day short course mode. The remaining 30 credit points may be from a 30 credit point project, or any combination of 7.5 or 15 credit point subjects available within the School. Elective subjects from other faculties can be taken with the approval of the course coordinator.

CVEN7819	Hydrological Processes
CVEN7802	Coastal Dynamics
CVEN7803	Coastal & Beach Processes
CVEN7804	Coastal Structures
CVEN7805	Coastal Zone Management
CVEN7807	Groundwater Hydrology
CVEN7812	Natural and Artificial Wetlands
CVEN7813	Estuarine Processes
CVEN7806	Catchment and Water Quality Management
CVEN7824	Risk Analysis in Engineering
CVEN7801	Design of Stormwater Structures
CVEN7811	Sediment Transport in Alluvial River Systems

8612.5500 Hydrology and Water Resources

All subjects in this 90 credit point core are 7.5 credit point subjects offered in 3-day short course mode. The remaining 30 credit points may be from a 30 credit point project, or any other combination of subjects available within the School. Elective subjects from other faculties can be taken with the approval of the course coordinator.

CVEN7819	Hydrological Processes
CVEN7820	Rainfall and Runoff Processes
CVEN7800	Urban Hydrology and Stormwater
CVEN7807	Groundwater Hydrology
CVEN7821	Water Resources Modelling I
CVEN7806	Catchment and Water Quality Management
CVEN7815	Introduction to Catchment Models
CVEN7816	Catchment Surface Models
CVEN7814	Flood Estimation
CVEN7824	Risk Analysis in Water Engineering
GEOL9112	Investigation and Management of Salinity
CVEN7812	Natural and Artificial Wetlands

8612.5600 Water Quality Management

All subjects in this 90 credit point core are 7.5 credit point subjects offered in 3-day short course mode. The remaining 30 credit points may be from a 30 credit point project, or any other combination of subjects available within the School. Elective subjects from other faculties can be taken with the approval of the course coordinator.

CVEN7819	Hydrological Processes
CVEN7807	Groundwater Hydrology
CVEN7812	Natural and Artificial Wetlands
CVEN7825	Aquatic Chemistry for Engineering
CVEN7826	Microbiology for Engineering
CVEN7806	Catchment and Water Quality Management
CVEN7815	Introduction to Catchment Models
CVEN7824	Risk Analysis in Water Engineering
CVEN7816	Catchment Surface Models
CVEN7805	Coastal Zone Management
CVEN7827	Contaminant Transport in the Environment
CVEN7828	Transformation and Fate of Contaminants

8615
Master of Environmental Engineering Science

MEnvEngSc
(Internal Mode Delivery)

Core Subjects

CVEN9884	Environmental Engineering Science 1
CVEN9885	Environmental Engineering Science 2
CVEN9888	Environmental Management
CVEN9889	Environmental Economics and Law

Elective Subjects

Elective subjects are chosen from those offered by the School of Civil and Environmental Engineering or other subjects approved by the course coordinator.

8617
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:

8612.1500 Engineering Construction and Management

8612.1600 Project Management

8612.1700 Construction Management

8612.1800 Engineering/Technology Management

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

Management

CVEN8701	Engineering Economics and Financial Management
CVEN8702	Project Planning and Control
CVEN8703	Quality and Quality Systems
CVEN8706	Human Resources Management
CVEN8708	Asset Management
CVEN8707	Contracts Management
CVEN8710	Management of Risk
CVEN8711	Management and Professional Services
CVEN8714	Resource Management
CVEN8717	Marketing in Technology and Engineering
CVEN8718	Strategic Management in Engineering
CVEN8720	Problem Solving and Decision Making
CVEN8730	International Project Management
CVEN8726	Legal Studies and Professional Practice
CVEN8731	Project Management Framework

Construction

CVEN8723	Design of Construction Operations
CVEN8724	Construction Engineering and Technology
CVEN8727	Construction Estimating and Tendering

Project/Thesis

CVEN8930	Masters Project

8617.5000 Water Engineering

- Waste Management
- Water and Wastewater Treatment
- Groundwater Studies

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.

Details of each specialisation's core requirements are given below:

8617.5100 Waste Management

CVEN8851	Unit Operations in Water and Waste Management
CVEN8872	Solid Waste Management
CVEN8881	Hazardous Waste Management
CVEN8884	Environmental Engineering Science 1
CVEN8885	Environmental Engineering Science 2

8617.5200 Water and Wastewater Treatment

CVEN8851	Unit Operations in Water and Water Management
CVEN8855	Water and Wastewater Analysis and Quality Requirements
CVEN8856	Water Treatment
CVEN8857	Wastewater Treatment
CVEN8884	Environmental Engineering Science 1

8617.5300 Groundwater Studies

CVEN8860	Investigation of Groundwater Resources
CVEN8861	Environmental and Engineering Geophysics
CVEN8875	Hydrological Processes
CVEN8884	Environmental Engineering Science 1
CVEN8891	Groundwater Contamination and Remediation

Additional Subjects

CVEN8888	Environmental Management
CVEN8889	Environmental Economics and Law
CVEN8930	Masters Project

8618
Master of Environmental Engineering Science

MEnvEngSc
(External Mode Delivery)

This course is offered on a fee-paying basis.

Core subjects

CVEN8884	Environmental Engineering Science 1
CVEN8885	Environmental Engineering Science 2
CVEN8888	Environmental Management
CVEN8889	Environmental Economics and Law

Elective subjects

CVEN8851	Unit Operations in Water and Waste Management
CVEN8855	Water and Wastewater Analysis and Quality Requirements
CVEN8856	Water Treatment
CVEN8857	Wastewater Treatment
CVEN8860	Investigation of Groundwater Resources
CVEN8861	Environmental and Engineering Geophysics

CVEN8872	Solid Waste Management
CVEN8875	Hydrological Processes
CVEN8881	Hazardous Waste Management
CVEN8891	Groundwater Contamination and Remediation
CVEN8930	Masters Project

Graduate Diplomas in Civil and Environmental Engineering

Graduate Diploma students undertake 90 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 45 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
Graduate Diploma

GradDip
External Mode Delivery

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

Engineering Construction and Management, Project Management, Construction Management and Technology Management.

Water Engineering

Water and Wastewater Treatment and Groundwater Studies.

Certificate in Civil and Environmental Engineering

The School of Civil and Environmental Engineering offers a Certificate qualification which will be awarded on the successful completion of postgraduate subjects totalling 60 credit points. There is a wide range of subjects available in a range of delivery modes including internal, external and short course modes.

The Certificate program will suit those wishing to pursue a specialised range of subjects or those who have limited qualifications together with relevant professional experience. Enquiries and applications should be directed to the School.

Students may continue with their postgraduate studies by subsequently enrolling in a Graduate Diploma or Master of Engineering Science degree program and may be granted advanced standing.

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.

CVEN0616
Structures
Staff Contact: A/Prof F Tin Loi
CP5 S1 L1 T1
Note/s: This is a servicing subject for courses offered by other schools and faculties.

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

CVEN0636
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.

CVEN0646
Engineering for Surveyors 1
Staff Contact: A/Prof RJ Cox
CP7.5 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.

CVEN0656
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.

CVEN1011
Civil Engineering Practice 1
Staff Contact: Dr SJ Foster
CP22.5 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.

CVEN1015
Computing
Staff Contact: Dr GE Swarbrick
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 PCIs; computer management and computer systems; word processing; spreadsheets; data/report presentation; spatial visualisation; computer aided drafting; Pascal programming.

CVEN1312
Statics
Staff Contact: Prof RI Gilbert
CP10 S1 or S2 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.

CVEN1313
Dynamics
Staff Contact: Dr RE Lawther
CP7.5 S1 or S2 L1 T1
Corequisite: CVEN1312, 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.

CVEN1314
Mechanics of Solids
Staff Contact: Dr MM Attard
CP10 S2 or X1 L2 T1
Prerequisite: CVEN1312
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; Mohrìs circle; principle stresses.

CVEN1710
Environmental Engineering Practice 1
Staff Contact: A/Prof R Cox
CP22.5 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 studentsì 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.

CVEN2011
Civil Engineering Practice 2
Staff Contact: School Office
CP30 F L2 T2
Prerequisites: 90 CP from Year 1 including CVEN1011

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.

CVEN2116
Engineering Construction
Staff Contact: Mr JB OìBrien
CP10 F L1 T1
Prerequisite: CVEN1011
Corequisite: CVEN2011

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.

CVEN2312
Introduction to Structures
Staff Contact: School Office
CP5 S1 L1.5 T0.5
Prerequisite: CVEN1314

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).

CVEN2313
Structural Analysis 1
Staff Contact: Dr RE Lawther
CP7.5 S2 L2 T1
Prerequisite: CVEN1314

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

CVEN2314
Engineering Materials
Staff Contact: Dr N Gowripalan
CP12.5 F L1.5 T0.5 (S1) L2 T1 (S2)
Prerequisite: CVEN1314

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.

CVEN2321
Engineering Mechanics & Materials
Staff Contact: A/Prof F Tin Loi
CP15 F3
Prerequisites: CVEN1312

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.

CVEN2515
Water Engineering 1
Staff Contact: Dr JE Ball
CP7.5 S2 L2 T1
Prerequisites: CVEN1312, MATH1131 or MATH1141
Corequisites: CVEN1313, 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, Bernoullìs theory, momentum flux and force balances, energy losses, flow in pipes, infiltration.

CVEN2710
Environmental Engineering Practice 2
Staff Contact: Dr DA Luketina
CP30 F4
Prerequisites: 90 CP from Year 1 including CVEN1710

This subject follows Environmental Engineering Practice 1 and further develops the studentsì 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 studentsì 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.

CVEN3011
Civil Engineering Practice 3
Staff Contact: Dr MM Attard
CP20 F L1 T3
Prerequisite: 90 CP from Year 2 including CVEN2011

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.

CVEN3015
Engineering Computations
Staff Contact: School Office
CP10 F L1 T1
Prerequisites: CVEN1015, MATH2019

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.

CVEN3116
Engineering Management 1
Staff Contact: Prof D Carmichael
CP10 F L1 T1
Prerequisite: CVEN2011 or CVEN2710

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 organisation; use and management of information systems.

CVEN3214
Geotechnical Engineering 1
Staff Contact: Dr N Khalili
CP15 F L2 T1
Prerequisites: CVEN1314, MATH2019
Corequisite: CVEN3011

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; Mohrìs 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.

CVEN3312
Structural Engineering 1
Staff Contact: A/Prof M Bradford
CP12.5 S1 L4 T1
Prerequisites: CVEN2312, CVEN2313
Corequisite: CVEN3011

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.

CVEN3313
Structural Engineering 2
Staff Contact: A/Prof M Bradford
CP12.5 S2 L4 T1
Prerequisite: CVEN3312
Corequisite: CVEN3011

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.

CVEN3418
Transport Engineering 1
Staff Contact: Dr U Vandebona
CP5 S2 L1 T1
Prerequisites: CVEN2011, 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.

CVEN3428
Transport & Noise Engineering
Staff Contact: Dr U Vandebona
CP7.5 F S1 1 S2 2
Prerequisites: CVEN2710, 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.

CVEN3517
Water Engineering 2
Staff Contact: Dr D Luketina
CP15 F L2 T1
Prerequisites: CVEN2515, MATH2019
Corequisites: CVEN3011, 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.

CVEN3521
Principles and Applications of Aquatic Chemistry
Staff Contact: Prof T D Waite
CP7.5 S2 3
Prerequisites: CHEM1201, MATH2019
Corequisite: CVEN3517

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.

CVEN3710
Environmental Engineering Practice 3
Staff Contact: Dr RI Acworth
CP20 F4
Prerequisites: 90 CP from Year 2 including CVEN2710

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.

CVEN4008
Industrial Training - Civil
Staff Contact: Mr G Nawar
CP0 S2

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.

CVEN4011
Civil Engineering Practice 4
Staff Contact: School Office
CP20 F L1 T3
Prerequisite: 90CP from Year 3 including CVEN3011
Corequisites: CVEN4214, CVEN4312, CVEN4413, CVEN4515

Similar in format to CVEN 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.

CVEN4018
Honours Thesis
Staff Contact: School Office
CP15 F3

Prerequisites: All third year and WAM $\geq$ 65

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.

CVEN4116
Engineering Management 2
Staff Contact: School Office
CP5 S1 L1 T1
Prerequisites: CVEN3011, CVEN3116

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

CVEN4119
Construction Major
Staff Contact: School Office
CP25 S2 L6 T2
Prerequisites: CVEN4116 and 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.

CVEN4214
Geotechnical Engineering 2
Staff Contact: School Office
CP7.5 S1 L2 T1
Prerequisite: CVEN3214

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.

CVEN4219
Geotechnical Major
Staff Contact: School Office
CP25 S2 L6 T2
Prerequisites: CVEN4214, CVEN4413

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 2 1/2 days duration.

CVEN4229
Geotechnical Major – Environmental
Staff Contact: School Office
CP20 S2 6
Prerequisites: All Year 3 subjects
Corequisites: CVEN4710

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.

CVEN4312
Structural Engineering 3
Staff Contact: School Office
CP7.5 S1 L2 T1
Prerequisite: CVEN3313
Corequisite: CVEN4011

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.

CVEN4319
Structures Major
Staff Contact: School Office
CP25 S2 L6 T2
Prerequisite: CVEN4312

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.

CVEN4413
Transport Engineering 2
Staff Contact: School Office
CP7.5 S1 L2 T1
Prerequisites: CVEN3214, CVEN3313, CVEN3418

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.

CVEN4419
Transport Major
Staff Contact: School Office
CP25 S2 L6 T2
Prerequisites: CVEN3418, CVEN4413

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.

CVEN4429
Transport Major – Environmental
Staff Contact: School Office
CP20 S2 6
Prerequisites: All Year 3 subjects
Corequisite: CVEN4710

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.

CVEN4515
Water Engineering 3
Staff Contact: School Office
CP7.5 S1 L2 T1
Prerequisite: CVEN3517
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.

CVEN4519
Water Major
Staff Contact: School Office
CP25 S2 L6 T2
Prerequisite: CVEN4515

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.

CVEN4522
Environmental Water Engineering
Staff Contact: School Office
CP12.5 F S1 3 S2 2
Prerequisites: CVEN3517, CVEN3521

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.

CVEN4523
Transport and Fate of Pollutants in Coastal and Groundwater Environments
Staff Contact: School Office
CP7.5 S1 3
Prerequisite: CVEN3521
Corequisite: CVEN4522

This subject builds on and integrates material covered in CVEN3521 and CVEN4522. 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.

CVEN4529
Water Major – Environmental
Staff Contact: School Office
CP20 S2 6
Prerequisites: All Year 3 subjects
Corequisites: CVEN4523, CVEN4710

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.

CVEN4710
Environmental Engineering Practice 4
Staff Contact: School Office
CP20 F 4
Prerequisite: 90CP from Year 3 including CVEN3710

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.

CVEN4717
Industrial Training – Environmental
Staff Contact: School Office
CP0 S2
Prerequisite: CVEN3710
Corequisite: CVEN4710

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.

CVEN4718
Honours Thesis
Staff Contact: School Office
CP15 F 3
Prerequisites: All Year 3 subjects
Corequisites: CVEN4710 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.

CVEN4720
Waste Management and Site Remediation
Staff Contact: School Office
CP7.5 S1 3
Prerequisite: CVEN3214
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.

CVEN4730
Environmental Management
Staff Contact: School Office
CP10 S1 4
Prerequisite: CVEN3710

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, îself regulationì 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.

Postgraduate Short Course Mode Subjects

CVEN7800
Urban Hydrology and Stormwater
Staff Contact: Dr J E Ball
Corequisite: CVEN7819
Excluded: CVEN9832
CP7.5 S1

An introduction to human impacts on the hydrological cycle with an emphasis on the additional factors that need consideration in urban environments, an introduction to impacts of urban development on stormwater quantity and quality, management of urban stormwater quantity and quality, an introduction to impacts of urban developments on groundwater, case studies.

CVEN7801
Design of Stormwater Structures
Staff Contact: Dr J E Ball
Excluded: CVEN9832
CP7.5 S1

Design of stormwater quantity and quality management structures such as detention basins, retention basins, infiltration basins, artificial wetlands, gross pollutant traps, sedimentation basins, and pollution booms.

CVEN7802
Coastal Dynamics
Staff Contact: A/Prof R Cox
Excluded: CVEN 9835
CP7.5 S1

Theory of periodic waves in coastal waters. Wave growth, refraction, diffraction, shoaling and breaking processes. Measurement, analysis and prediction of waves.

CVEN7803
Coastal and Beach Processes
Staff Contact: A/Prof R Cox
Corequisite: CVEN7802
Excluded: CVEN9835
CP7.5 S1

Coastal and beach processes including tides, storms, currents and elevated water levels, morphology, sediment transport mechanisms, beach erosion and nourishment, prediction and modelling of shoreline change.

CVEN7804
Coastal Structures
Staff Contact: A/Prof R Cox
Prerequisite: CVEN7802
Excluded: CVEN9836
CP7.5 S2

Wave forces on coastal and ocean structures with application to practical engineering design of harbours, breakwaters, seawalls, piles, decks, marinas, pipelines and outfalls.

CVEN7805
Coastal Zone Management
Staff Contact: A/Prof R Cox
Excluded: CVEN9836
CP7.5 S2

Coastal hazards and management options assessment within local, State and Federal government frameworks. Environmental and ecological aspects including climate change and marine biota. Dredging and spoil disposal. Asset management and risk assessment in the coastal zone.

CVEN7806
Catchment and Water Quality Management
Staff Contact: Prof T D Waite
Excluded: CVEN9858
CP7.5 S1

Fundamental concepts, total catchment management, issues in non-urban catchment inclusive of non-point-source contamination and erosion, water quality management in catchments, rivers, lakes, reservoirs, estuaries and the coastal zone.

CVEN7807
Groundwater Hydrology
Staff Contact: Dr R I Acworth
Corequisite: CVEN7819
Excluded: CVEN9860
CP7.5 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. Groundwater modelling. Unsaturated zone flow and calculation of infiltration. Groundwater recharge mechanisms and water balance calculations.

CVEN7808
Investigation of Groundwater Resources
Staff Contact: Dr R I Acworth
Corequisite: CVEN7807
Excluded: CVEN9860
CP7.5 S1

Groundwater investigation methods. Drilling methods; well design and completion for water production and contamination investigation. Contract specification and supervision. Solutions to the radial flow equation; pumping test interpretation; programme of field work and data analysis.

CVEN7809
Geophysical Techniques in Groundwater Studies
Staff Contact: Dr R I Acworth
Excluded: CVEN9861
CP7.5 S2

Introduction to geophysical methods in civil and environmental engineering; physical properties of soils, rocks and contaminated material. Seismic methods – field equipment and methods for seismic refraction. Properties of seismic waves. Cross-hole surveys and characterisation of bulk modulii. Seismic refraction interpretation methods. Borehole geophysics – field equipment and methods; caliper, electrical, fluid, nuclear and electromagnetic logs. Gravity and magnetic methods. Case histories describing the use of geophysical methods in engineering and environmental investigation.

CVEN7810
Electrical Methods in Groundwater Investigation
Staff Contact: Dr R I Acworth
Excluded: CVEN9861
CP7.5 S2

Electrical properties of water, soil, rock and contaminants. The frequency dependence of electrical conductivity and relative permittivity. Relationships between porosity, clay content, fluid conductivity and bulk electrical conductivity. Electrical conductivity sounding and profiling using galvanic and induction techniques. Electrical conductivity imaging. Forward and inverse modelling of conductivity images. Time domain methods. Ground probing radar methods.

CVEN7811
Sediment Transport in Alluvial River Systems
Staff Contact: A/Prof R Cox
Excluded: CVEN9862
CP7.5 S2

Catchment and river morphological processes including river response to changed conditions and river engineering and management. Sediment transport estimation for cohesive and non-cohesive materials including computer modelling application packages.

CVEN7812
Natural and Artificial Wetlands
Staff Contact: Dr D A Luketina
Corequisite: CVEN7819
Excluded: CVEN9863
CP7.5 S1

The objective of this subject is to extend the student's knowledge of physical and biochemical processes which occur in wetlands and how to measure, model and predict those processes. Wetland classification and components. Wetland hydrodynamics and forcing. Water balance. Pollutant characterisation. Biochemical processes. Biofilms. Macrophytes. Nutrient and pathogen removal. Wetland design, modification and maintenance. Data collection.

CVEN7813
Estuarine Processes
Staff Contact: Dr DA Luketina
Excluded: CVEN9863
CP7.5 S2

The objective of this subject is to extend the student's knowledge of physical and biochemical processes which occur in estuaries and how to measure, model and predict those processes. Topics include estuarine classification and density structure. Tides and water level response of estuaries. Tidal flushing of estuaries and inlets. Mixing processes and random walk and box models. Two layer models. Difference models for hydrodynamics and algal dynamics. Biochemical processes in estuaries.

CVEN7814
Flood Estimation
Staff Contact: A/Prof I Cordery
Excluded: CVEN9866
CP7.5 S1

Introduction and background to flood estimation; frequency analysis of hydrological data; flood frequency analysis; design rainfall data; regional flood methods; rational methods; estimation of extremes.

CVEN7815
Introduction to Catchment Models
Staff Contact: Dr J E Ball
Corequisite: CVEN7820
Excluded: CVEN9867
CP7.5 S2

An introduction to the concepts and reductionist approach involved in the modelling of catchment processes influencing the quantity and quality of surface runoff from a catchment. Also introduced are the different forms of models, how these models are combined to provide a catchment modelling system, and implementation of catchment modelling systems. The information and data required for operation of these modelling systems and sources of this information are discussed also. Finally, the calibration, validation, and reliability of catchment modelling systems is presented.

CVEN7816
Catchment Surface Models
Staff Contact: Dr J E Ball
Corequisite: CVEN7814, CVEN7815
Excluded: CVEN9867
CP7.5 S2

An introduction to processes influencing the generation of surface runoff and the transportation of pollutant constituents with the surface runoff. The surface runoff models considered include UH methods, time-area methods, linear and non-linear reservoir models and, kinematic wave methods. Water quality models considered include UAL, Simple methods, and process based models. Selection of appropriate models is discussed also.

CVEN7817
Water in Mining Engineering
Staff Contact: Dr R I Acworth
Prerequisite: CVEN7807
Excluded: CVEN9871
CP7.5 S1

Hydrological cycle and sources of mine water; mine dewatering strategies; groundwater flow into mines; consolidation and drainage of fine-grained material during dewatering; monitoring the effects of mining on regional groundwater resources.

CVEN7818
Channel and River Models
Staff Contact: Dr J E Ball
Corequisite: CVEN7815
Excluded: CVEN9871
CP7.5 S1

Selection of models for routing flows along the channels and rivers in a catchment drainage network. Also included is a detailed discussion of the theory of these models. Models considered include Muskingum with both variable and constant parameters, kinematic wave models, non-inertial and diffusion models, and dynamic wave models. These models will be discussed with reference to single channel situations and network situations. Also included is a discussion of water quality models for motion of pollutant constituents in channels and rivers. These models will include plug-flow methods, and advection-dispersion models in both a coupled and uncoupled situation.

CVEN7819
Hydrological Processes
Staff Contact: A/Prof I Cordery
Excluded: CVEN9875
CP7.5 S1

Hydrological cyle; atmospheric circulation; weather systems and oceanic circulation; moisture in the atmosphere; measurement of meterological parameters; calculation of potential evaporation and evapotranspiration.

CVEN7820
Rainfall and Runoff Processes
Staff Contact: A/Prof I Cordery
Corequisite: CVEN7819
Excluded: CVEN9875
CP7.5 S1

Precipitation processes; interception and infiltration; storm runoff processes; loss models; hydrograph analysis

CVEN7821
Water Resources Modelling 1
Staff Contact: Dr J E Ball
Prerequisite: CVEN7819
Corequisite: CVEN7824
Excluded: CVEN9876
CP7.5 S1

Water resources data – sources, errors and corrections; introduction to storage yield relationships for reservoir design; extension of hydrological records; introduction to time series analysis.

CVEN7822
Water Resources Modelling 2
Staff Contact: Dr J E Ball
Corequisite: CVEN7821
Excluded: CVEN9876
CP7.5 S1

Time series analysis; stochastic models; stochastic reservoir analysis; optimisation in water resources

CVEN7823
Applied Groundwater Modelling
Staff Contact: Dr R I Acworth
Prerequisite: CVEN7807
Excluded: CVEN9880
CP7.5 S2

Equations and numerical methods; conceptual model and grid design; boundaries; sources and sinks of ground water; model execution and calibration; profile models; particle tracking.

CVEN7824
Risk Analysis in Water Engineering
Staff Contact: Dr A Sharma
Excluded: CVEN9880
CP7.5 S2

Introduction to the theory of probability; joint, marginal and conditional probability; commonly used probability distributions; expectations and estimation of model parameters; hypothesis testing and confidence limits; uses in water and coastal engineering – applications to flood design, monte carlo simulation, bootstrap, and hydrological, human and environmental risk assessment.

CVEN7825
Aquatic Chemistry for Engineering
Staff Contact: Prof T D Waite
Excluded: CVEN9884
CP7.5 S1

Introduction to principles of the chemistry of natural waters and polluted systems covering basic processes of acidity and alkalinity, mineral precipitation, complexation, oxidation/reduction and surface and colloid chemistry. Tools developed enabling solution of realistic water chemistry problems including introduction to use of chemical speciation computer codes.

CVEN7826
Microbiology for Engineering
Staff Contact: A/Prof N Ashbolt
Corequisite: CVEN7825
Excluded: CVEN9884
CP7.5 S1

The objective of this unit is to familarise the student with the fundamentals of water and wastewater chemistry along with the microbiology that drives most of these reactions in various environments. A structured approach is used to

introduce concepts governing chemical equilibria, reaction rates, pH, alkalinity, oxidation-reduction and complexation, and integrates this knowledge with an understanding of microbial growth, metabolic diversity and persistence of disease-causing microorganisms.

CVEN7827
Contaminant Transport in the Environment
Staff Contact: Dr D A Luketina
Prerequisite: CVEN7825
Excluded: CVEN9885
CP7.5 S2

Fundamentals of dispersion common to all environmental media (air, water, soil). Dispersion processes: nature of dispersion processes, advection and diffusion. Modelling of dispersion in the atmosphere, water bodies and soil. Transport processes in wetlands, lakes, reservoirs, estuaries, and coastal waters. Data collection relating to transport and dispersion.

CVEN7828
Transformation and Fate of Contaminants in the Environment
Staff Contact: Prof T D Waite
Prerequisite: CVEN7825
Corequisite: CVEN7827
Excluded: CVEN9885
CP7.5 S2

Major variables and general principles of the transformation and fate of pollutants. Air chemistry: interaction and degradation of gaseous pollutants in the atmosphere. Aquatic chemistry: transformation and fate of particles, organic contaminants, nutrients and metals released to coastal waters.

CVEN7829
Decision Support Systems in Water Engineering
Staff Contact: Dr J E Ball
Corequisite: CVEN7815
Excluded: CVEN9890
CP7.5 S1

Principles of decision support systems and their application in decision making in water resources, expert systems, GIS concepts, an introduction to introduction to hydroinformatic concepts, and error analysis.

CVEN7830
Physical Aspects of Contaminated Groundwater
Staff Contact: Dr R I Acworth
Excluded: CVEN9891
CP7.5 S2

Sources of groundwater contamination; diffusion and dispersion; tracer tests; review of organic chemistry; contamination by light non-aqueous phase liquids (LNAPL) and dense non-aqueous phase liquids (DNAPL); gas chromatographic analysis techniques; case studies of LNAPL and DNAPL contaminant investigation.

CVEN7831
Chemical and Biological Aspects of Contaminated Groundwater
Staff Contact: Prof T D Waite
Corequisite: CVEN7830
Excluded: CVEN9891
CP7.5 S2

The source and sink mechanisms for inorganic and organic groundwater contaminates are described along with an insight into the mechanisms of critical chemical and microbiological transformations. The nature of groundwater microbes in natural and artificially contaminated systems are explained against a background focused on chemical and microbiological remediation of groundwater contaminants. Case examples are worked through for a range of contaminated sites.

External Mode Subjects

CVEN8701
Engineering Economics and Financial Management
Staff Contact: Prof D G Carmichael
CP15 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; optimisation; applications; multiple objective planning; project delivery systems; financial planning, accounting.

CVEN8702
Project Planning and Control
Staff Contact: Prof D G Carmichael
CP15 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.

CVEN8703
Quality and Quality Systems
Staff Contact: Prof D G Carmichael
CP15 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.

CVEN8706
Human Resources Management
Staff Contact: Mr JB O'Brien
CP15 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.

CVEN8707
Contracts Management
Staff Contact: Prof DG Carmichael
CP15 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.

CVEN8708
Asset Management
Staff Contact: Prof DG Carmichael
CP15 SS

The management of infrastructure assets. Regulatory requirements. Asset management plans, goals and approaches. Life cycle principles. Strategies, creation/ acquisition, account/economics, operations and maintenance, conditions and performance monitoring, renewal/rehabilitation/replacement/augmentation/, disposal/rationalisation, audits. Valuation, capitalisation. Heritage assets.

CVEN8710
Management of Risk
Staff Contact: Mr G Nawar
CP15 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.

CVEN8711
Management of Professional Services
Staff Contact: Prof DG Carmichael
CP15 SS

The Management of the delivery of professional engineering and technology services which are predominantly knowledge-based, such as designs, reports and investigations. The client relationship. Planning and control of work, staff and resources. Marketing including the promoting and pricing of services. Contracts for the provision of services. The design process and organisation and team management. Financial management of the engineering/ technology firm.

CVEN8714
Resource Management
Staff Contact: Prof DG Carmichael
CP15 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; optimisation, applications; resource planning; resource disposal.

CVEN8717
Marketing in Technology and Engineering
Staff Contact: Prof DG Carmichael
CP15 S2

The interface of technology and engineering with marketing. Marketing of professional consultant services; promoting; 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.

CVEN8718
Strategic Management in Engineering
Staff Contact: Prof DG Carmichael
CP15 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 type.

CVEN8720
Problem Solving and Decision Making
Staff Contact: Prof D G Carmichael
CP15 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, and the development of multidisciplinary problems.

CVEN8723
Design of Construction Operations
Staff Contact: Prof D G Carmichael
CP15 S1

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.

CVEN8724
Construction Engineering and Technology
Staff Contact: Mr JB O'Brien
CP15 SS

Structure of the construction industry; construction engineering theory, construction processes: methods engineering, automation and mechanisation 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. .

CVEN8726
Legal Studies and Professional Practice
Staff Contact: Prof DG Carmichael
CP15 SS

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.

CVEN8727
Construction Estimating and Tendering
Staff Contact: Prof DG Carmichael
CP15 SS

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.

CVEN8730
International Project Management
Staff Contact: Prof DG Carmichael
CP15 S1

International project management practices and a comparison with local practices. Managing projects overseas. Multicultural managment including values, human resources, negotiations and diversity. Globalisation. Technology transfer. Appropriate technology. Joint ventures. The management of time, costs, quality, risk, resources and people in an international setting. International contracts and dispute resolution. International marketing.

CVEN8731
Project Management Framework
Staff Contact: Mr JB OiBrien
CP15 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.

CVEN8799
Geotechnics of Waste Disposal and Site Remediation
Staff Contact: Dr GE Swarbrick
CP15 S2

Soil and contaminant chemistry, soil-contaminant interaction, movement of water and contaminants through the saturated and vadose zones, advection and dispersion of contaminants, gas flow and diffusion, contaminated site investigation management, risk assessment, soil and groundwater remediation, landfill leachate and gas management, and mine waste disposal and management, dredged waste disposal and management, field trip to inspect an landfill and/or a mining project.

CVEN8851
Unit Operations in Water and Waste Management
Staff Contact: Mr PJ Bliss
CP15 S1

Theory and principles of physical, chemical and hydraulic unit processes which are common to both water and wastewater treatment; energy dissipation and modelling; mixing; sedimentation; flotation; filtration; aeration; coagulation and flocculation; gas transfer; disinfection; heat transfer; combustion; sludge characterisation, thickening and dewatering; and activated carbon.

CVEN8855
Water and Wastewater Analysis and Quality Requirements
Staff Contact: Prof T D Waite
CP15 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.

CVEN8856
Water Treatment
Staff Contact: Prof T D Waite
CP15 S2

Integrated design of facilities for the treatment of various types of raw water to meet specified water quality, with emphasis on water for municipal supply, including: chemical selection, dosing and mixing; coagulation – flocculation –

clarification – filtration and disinfection technology. Processes for water softening, iron and manganese removal and demineralisation, including precipitation oxidation, ion exchange reverse osmosis. Taste and odour control. Disposal of water treatment residuals.

CVEN8857
Wastewater Treatment
Staff Contact: Mr PJ Bliss
CP15 S2

Principles and applications of aerobic and anaerobic biological processes for treatment of wastewaters and sludges. Design of integrated systems of biological, physical, chemical and sludge treatment processes to satisfy effluent quality objectives. Effluent disposal and reuse. Stabilisation, processing, disposal and utilisation of treatment residuals.

CVEN8860
Investigation of Groundwater Resources
Staff Contact: Dr RI Acworth
CP15 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. Unsaturated zone flow and calculation of infiltration. Drilling methods; well design an completion. Contract specification and supervision. Borehole geophysical methods. Solutions to the radial flow equation; pumping test interpretation. Groundwater modelling – finite difference methods. Groundwater recharge mechanisms and water balance calculations; Programme of field work and data analysis.

CVEN8861
Environmental and Engineering Geophysics
Staff Contact: Dr RI Acworth
CP15 SS

Electrical properties of water, soil, rock and contaminants. The frequency dependence of electrical conductivity and relative permitivity. Relationships between porosity, clay content, fluid conductivity and bulk electrical conductivity. Electrical conductivity sounding and profiling using galvanic and induction techniques. Electrical conductivity imaging. Forward and inverse modelling of conductivity images. Time domain methods. Ground probing radar methods. Borehole applications of electromagnetic methods. Gamma and neutron methods applied to borehole measurements. Magnetic methods. Case studies related to contaminated site assessment.

CVEN8872
Solid Waste Management
Staff Contact: Mr SJ Moore
CP15 SS

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

CVEN8875
Hydrological Processes
Staff Contact: A/Prof I Cordery
CP15 SS

Introduction to hydrological cycle and energy balance; meteorology; precipitation processes and analysis; interception and infiltration; evaporation; storm runoff processes; hydrograph analysis; loss models.

CVEN8881
Hazardous Waste Management
Staff Contact: Mr SJ Moore
CP15 SS

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.).

CVEN8884
Environmental Engineering Science 1
Staff Contact: Prof TD Waite
CP15 S1

Application of chemical principles to aqueous systems; pH and alkalinity, solubility and precipitation, complexation, redox and surface chemistry. Chemical equilibrium modelling. Introduction to chemical reaction kinetics.

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.

CVEN8885
Environmental Engineering Science 2
Staff Contact: Dr DA Luketina
CP15 S2

Processes controlling transformation and fate of chemicals in the environment. Measurement and prediction of contaminant behaviour in natural and engineered systems. 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.

CVEN8888
Environmental Management
Staff Contact: Mr SJ Moore
CP15 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.

CVEN8889
Environmental Economics and Law
Staff Contact: A/Prof NJ Ashbolt
CP15 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.

CVEN8891
Groundwater Contamination and Remediation
Staff Contact: Dr RI Acworth
CP15 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.

CVEN8901
Special Topic in Civil Engineering
Staff Contact: School Office
CP15 SS

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

CVEN8930
Masters Project
CP30 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.

CVEN8940
Special Topic in Civil Engineering
Staff Contact: School Office
CP5 SS

The syllabus and format changes to allow presentation of a special topic of current interest, including a topic covered by an approved short course, and a topic taught by a visitor with recognised expertise in the area.

CVEN8980
Special Topic in Civil Engineering
Staff Contact: School Office
CP10 SS

The syllabus and format changes to allow presentation of a special topic of current interest, including a topic covered by an approved short course, and a topic taught by a visitor with recognised expertise in the area.

Internal Mode Subjects

CVEN9403
Theory of Land Use Transport Interaction
Staff Contact: Prof JA Black
CP15 SS

Theoretical aspects of land use transport planning. Basic concepts, data collection methods, systems models and equation of state function (behavioural, optimising). 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).

CVEN9405
Urban Transport Planning Practice
Staff Contact: Prof JA Black
CP15 SS

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.

CVEN9407
Transport Systems Design (Non-Urban)
Staff Contact: Dr P Hidas
CP15 SS

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.

CVEN9408
Transport Systems Design (Urban)
Staff Contact: Prof JA Black
CP15 SS

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.

CVEN9410
Highway Engineering Practice
Staff Contact: Prof JA Black
CP15 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.

CVEN9414
Transport Systems Part 1
Staff Contact: Dr U Vandebona
CP15 S1

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

CVEN9415
Transport Systems Part 2
Staff Contact: Dr U Vandebona
CP15 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 queuing 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.

CVEN9418
Transport and Social Impact Assessment
Staff Contact: Prof JA Black
CP15 SS

Framework for social, economic and environmental impact assessment. System component and equations of state. Environmental costs. Decision making frameworks and community participation. Accessibility and social severance. Environmental impacts of transport and human responses to these impacts. Environmental impact amelioration in the community context. Road, rail and air transport case studies.

CVEN9420
Special Topic in Transport Engineering
Staff Contact: Prof JA Black
CP15 SS

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

CVEN9421
Fundamentals of Traffic Engineering
Staff Contact: Dr P Hidas
CP15 S1

Traffic flow, concentration and speed. Fundamental diagram of traffic. Measurements, data collection presentation and statistical analysis. Traffic surveys; volume, composition, speed and travel time. Highway capacity and level of service: multi-lane and two-way-two-lane roads, urban roads, HCM-software calculations. Economic analysis of transport investments.

CVEN9422
Traffic Management and Control
Staff Contact: Dr P Hidas
CP15 S2

Unsignalised intersections; operating characteristics, capacity and delay. Signalised intersections; capacity and timing analysis. Signal coordination. Intersection analysis with computer softwares (SIDRA, INTANAL). The functional hierarchy of urban road networks. Aterial road traffic management. Local Area Traffic Management, Traffic Calming. Travel Demand Management.

CVEN9423
Transport Environmental Analysis, Assessment and Control
Staff Contact: Prof JA Black
CP15 S2

The state of the transport environment. Environmentally sustainable transport. Environmental impact assessment. Road traffic noise generation, prediction, assessment and control. Case studies of transport infrastructure proposals. Vehicle emissions and air quality. Airport noise and air quality.

CVEN9701
Engineering Economics and Financial Management
Staff Contact: Prof DG Carmichael
CP15 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; optimisation;

applications; multiple objective planning; project delivery systems; financial planning, accounting.

CVEN9702
Project Planning and Control
Staff Contact: Prof DG Carmichael
CP15 SS

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.

CVEN9703
Quality and Quality Systems
Staff Contact: Dr P Gibson
CP15 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.

CVEN9706
Human Resources Management
Staff Contact: Mr JB O'Brien
CP15 SS

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; the structure and function of organisations, management of group action; work delegation across organisational boundaries; interpersonal skills, conflict management; learning curves; motivation.

CVEN9707
Contracts Management
Staff Contact: Prof DG Carmichael
CP15 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.

CVEN9708
Asset Management
Staff Contact: Prof DG Carmichael
CP15 SS

The management of infrastructure assets. Regulatory requirements. Asset management plans, goals and approaches. Life cycle principles. Strategies, creation/ acquisition, accounting/economics, operations and maintenance, conditions and performance monitoring, renewal/rehabilitation/replacement/ /augmentation, disposal/rationalisation, audits. Valuation, capitalisation. Heritage assets.

CVEN9710
Management of Risk
Staff Contact: Mr G Nawar
CP15 SS

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.

CVEN9711
Management of Professional Services
Staff Contact: Prof DG Carmichael
CP15 SS

The management of the delivery of professional engineering and technology services which are predominantly knowledge-based, such as designs, reports and investigations. The client relationship. Planning and control of work, staff and resources. Marketing including the promoting and pricing of services. Contracts for the provision of services. The design process and organisation and team management. Financial management of the engineering/technology firm.

CVEN9714
Resource Management
Staff Contact: Prof DG Carmichael
CP15 SS

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; optimisation applications; resource planning; resource disposal.

CVEN9717
Marketing in Technology and Engineering
Staff Contact: Prof DG Carmichael
CP15 S2

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.

CVEN9718
Strategic Management for Engineering
Staff Contact: Prof DG Carmichael
CP15 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.

CVEN9720
Problem Solving and Decision Making
Staff Contact: Mr JB O'Brien
CP15 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, and the development of multidisciplinary problems.

CVEN9723
Design of Construction Operations
Staff Contact: Prof DG Carmichael
CP15 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.

CVEN9724
Construction Engineering and Technology
Staff Contact: Mr JB O'Brien
CP15 SS

Structure of the construction industry; construction engineering theory, construction processes: methods engineering, automation and mechanisation 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.

CVEN9726
Legal Studies and Professional Practice
Staff Contact: Prof DG Carmichael
CP15 SS

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.

CVEN9727
Construction Estimating and Tendering
Staff Contact: Prof DG Carmichael
CP15 SS

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.

CVEN9730
International Project Management
Staff Contact: Prof DG Carmichael
CP15 S2

International project management practices and a comparison with local practices. Managing projects overseas. Multicultural managment including values, human resources, negotiations and diversity. Globalisation. Technology transfer. Appropriate technology. Joint ventures. The management of time, costs, quality, risk, resources and people in an international setting. International contracts and dispute resolution. International marketing.

CVEN9731
Project Management Framework
Staff Contact: Mr JB O'Brien
CP15 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.

CVEN9770
Introduction to Numerical Methods in Civil Engineering
Staff Contact: Prof S Valliappan
CP10 S1

Introduction to finite element and boundary element methods. Mathematical formulation of finite elements. Two and three dimensional elements. Linear and nonlinear analysis. Steady state and transient field problems – heat conduction, seepage etc. Dynamic analysis – frequency domain and time domain.

CVEN9772
Numerical Methods in Civil Engineering
Staff Contact: Prof S Valliappan
CP15 SS

Introduction to finite element and boundary element methods. Mathematical formulation of finite elements. Two and three dimensional elements. Linear and nonlinear analysis. Steady state and transient field problems – heat conduction, seepage etc. Dynamic analysis – frequency domain and time domain. Basic plate and shell elements – error estimation and adaptive finite element refinement

– infinite elements – mathematical formulation of boundary elements.

CVEN9775
Numerical Methods in Geotechnical Engineering
Staff Contact: Prof S Valliappan
CP10 SS

Introduction to computer programs based on finite element, boundary element and finite difference methods. Theory and application of FEM, BEM, FDM to foundations, slopes, embankments, dams, tunnels, seepage and consolidation.

CVEN9776
Rock Engineering for Underground Structures
Staff Contact: Prof R Fell
CP10 S1

A lecture and problem based course on the investigation, design and construction of tunnels and other underground structures, rock and rock mass strength and deformability; in-situ stresses; stresses about underground openings by elastic and numerical methods; classification systems for prediction of support requirements, including NATM; design of support elements including bolts, dowels, mesh and anchors. Measurement of in-situ stresses; instrumentation and monitoring; squeezing and swelling ground. Tunnel excavation methods and their applicability, including drill and blast, heading and bench, tunnel boring machine, road headers.

CVEN9779
Soil Dynamics and Earthquake Engineering
Staff Contact: Dr N Khalili
CP10 SS

Elements of soil dynamics, foundation design for dynamic loads, basic concepts of earthquake engineering, seismic analysis of dams and foundations, soil liquefaction.

CVEN9783
Pavement Materials
Staff Contact: A/Prof B Shackel
CP15 S1

Properties and usage of soil and rock as pavement materials. Response of pavement materials to traffic and environmental factors. Concepts of durability. Stabilisation using cement, line and bitumen. Selection and characterisation of subgrade, sub-base and base materials. Specifications and acceptance testing. Quality control. Properties and usage of bitumens,and asphalts . Polymers and other additives. Manufacture and use of bituminous concrete. Mix design. Sprayed seals. Concrete for rigid pavements and sub-bases. Lean concrete.

CVEN9784
Pavement Analysis and Design
Staff Contact: A/Prof B Shackel
CP15 S1

Types of pavement, selection on basis of cost and performance. Sub-grade conditions, working platforms. Role of environmental factors including temperature and moisture. Soil moisture equilibria and drainage requirements. Prediction and characterisaton of traffic loadings. Stress distribution in flexible and rigid pavements. Computer-based and approximate methods of analysis. Principles of mechanistic design. Comparative evaluation of design criteria and design procedures for flexible and rigid pavements for roads. Concrete block paving.

CVEN9785
Pavement Evaluation and Management
Staff Contact: A/Prof B Shackel
CP10 SS

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. Over-lays and membranes. Recycling. Maintenance scheduling and management.

CVEN9786
Industrial, Airport and Heavy Duty Pavements
Staff Contact: A/Prof B Shackel
CP10 S2

Functions of airport, industrial and heavy-duty pavements. Airport and port pavements, container facilities, bulk cargo areas, factory and warehouse floors and hardstand operation requirements. Economic considerations. Types of industrial pavement. Advantages and disadvantages of flexible, rigid and segmental pavements. Types of load, aircraft and industrial vehicles, container stacking, bulk cargo. Load equivalency concepts, port area wheel loads, standard design aircraft and vehicles, formulation and application of loading spectra. Subgrade improvement and characterisation. Selection of pavement materials. Pavement design procedures.

CVEN9788
Geotechnical Site Investigations
Staff Contact: Prof R Fell
CP15 S2

Geotechnical mapping and logging. Introduction to terrain evaluation, airphoto interpretation, remote sensing and engineering geophysics. Drilling, trenching, sampling and in-situ permeability testing of soil and rock. In-situ testing of soil, including SPT, CPT, piezocone, vane shear, dilatometer, pressuremeter, plate load. Laboratory testing of soil including triaxial, direct shear, ring shear, consolidation. Geotechnical model and design parameters. Field instrumentation for pore pressure and displacement. Environmental investigations – sampling of groundwater and contaminated soil, sample storage, testing.

CVEN9790
Soil and Rock Slope Instability and Stabilisation
Staff Contact: Prof R Fell
CP15 S1

Assessment of the stability, design and stabilisation of soil and rock slopes in civil and mining Engineering. Influence

of geology and hydrogeology; site investigations, laboratory testing and field instrumentation; analysis of stability using limit equilibrium and numerical methods; gathering of geological data and stereographic presentation and analysis; design of slopes in soil and rock; stabilisation methods including geometry change, control of piezometric pressures, anchoring, retaining walls, reinforced soil; design of slopes in soft ground; design of slopes for earthquake; open cut mine slopes and probabilistic design; landslide risk assessment and zoning.

CVEN9792
Foundation Engineering
Staff Contact: Prof S Valliappan
CP15 S2

Principles of foundation design. Design of conventional and special footings such as combined, cantilever etc, load capacity and settlement of single piles and pile groups subjected vertical and lateral loads, raft foundations, pile-raft systems, foundations on difficult soils, lateral earth pressure and sheet pile walls.

CVEN9793
Geomechanics
Staff Contact: Dr N Khalili
CP15 SS

The fundamentals of the effective stress concept, clay mineralogy, seepage analysis and Laplace Equation, basic and advanced theories of consolidation, nonlinearity and Biotìs theorem, critical state soil mechanics, fundamentals of continium mechanics, theory of elasticity, constitutive relationships and failure criteria for real soils, soil plasticity and cam-clay model, theorem of collapse, fundamentals of unsaturated soils mechanics.

CVEN9794
Geotechnical Engineering of Dams
Staff Contact: Prof R Fell
CP10 S1

Geotechnical engineering for embankment and concrete dams. Zoning of embankment dams. Weathering processes and profiles in valleys, Geotechnical questions associated with various geological environments Site investigations planning, and techniques, laboratory testing of soil and rock and selection of properties. Design specification and construction of filters. Stability analysis for embankment and concrete gravity dams. Foundation preparation, cleanup and grouting. Specification and quality control. Mine and industrial tailings dams. Monitoring and surveillance. Risk assessment methods.

CVEN9795
Design of Dams for Earthquakes
Staff Contact: Prof R Fell
CP5 S1

Assessment of existing and design of new embankment and concrete gravity dams for earthquake. Earthquakes in Australia, selection of design earthquake, risk assessment approach to design. General design principles, defensive design. Analysis of dynamic stability, and deformations of embankment and concrete gravity dams. Assessment of liquefaction potential and post liquefaction behaviour. Design of remedial measures.

CVEN9798
Fundamentals of Geomechanics
Staff Contact: Dr GE Swarbrick
CP5 S1

Fundamentals of Geomechanics for geologists and other professionals who wish to work in geotechnical engineering, in geotechnical engineering, engineering geology, and environmental engineering. Classification of soil, phase relationships, flow of water in soil. The principle of effective stress. Consolidation theory, stress distribution and settlement. Mohrs Circle, failure criteria, stress paths and strength of soils. Lateral earth pressures. Compaction of soil.

CVEN9799
Geotechnics of Waste Disposal and Site Remediation
Staff Contact: Dr GE Swarbrick
CP15 S2

Soil and contaminant chemistry, soil-contaminant interaction, movement of water and contaminants through the saturated and vadose zones, advection and dispersion of contaminants, gas flow and diffusion, contaminated site investigation management, risk assessment, soil and groundwater remediation, landfill leachate and gas management, and mine waste disposal and management, dredged waste disposal and management, field trip to inspect an landfill and/or a mining project.

CVEN9802
Structural Stability
Staff Contact: Dr RE Lawther
CP15 SS

Euler strut; uniform and non-uniform cross sections. Eccentric loading; stressing beyond the elastic limit. Struts continuous over several supports. Stability of frames.

CVEN9804
Vibration of Structures
Staff Contact: A/Prof F Tin-Loi
CP15 S2

Review of basic aspects. Analysis of lumped mass systems with various degrees of freedom. Vibration in beams and other continuous structures.

CVEN9806
Prestressed Concrete Design
Staff Contact: Dr MM Attard
CP15 S2

Introduction to prestressed concrete. Design for serviceability. Design for strength. Statically indeterminate beams. Behaviour and design of two-way slabs. End block design.

CVEN9809
Reinforced Concrete Design
Staff Contact: Dr SJ Foster
CP15 S1

Design of reinforced concrete structures. Topics covered will be chosen from: design of beam-columns, non-symmetric sections, flexure-shear-torsion, serviceability and detailing. Special provisions for the use of high strength concretes, strut and tie modelling and collapse load methods for the design of reinforced concrete slabs.

CVEN9814
Analysis of Plates and Shells
Staff Contact: A/Prof F Tin Loi
CP15 SS

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.

CVEN9818
Bridge Engineering
Staff Contact: A/Prof F Tin Loi
CP15 S1

Introduction to bridge engineering; site selection, type selection, bridge hydraulics, design philosophies. Transverse load distribution. Simple supported and continuous slabs on beam bridges. Box girder bridges. Cable-stayed bridges.

CVEN9820
Computational Structural Mechanics
Staff Contact: A/Prof F Tin Loi
CP15 S1

Stiffness analysis of structures. Basis of finite elements: principle of virtual work, variational theorems, constraint equations. Effects of inplane rigid floors and axially rigid members on the behaviour of multi-storey frames.

CVEN9822
Steel Structures
Staff Contact: A/Prof MA Bradford
CP15 S2

Introduction to limit states design. Design of compression members. Effective lengths of columns. Tension members. Local buckling. Design of plate girders. Lateral buckling of beams. Design by buckling analysis. Behaviour of beam-columns. Introduction to connection design.

CVEN9824
Advanced Materials Technology
Staff Contact: Dr N Gowripalan
CP15 S2

Concrete: high performance concrete; new methods of workability measurement; methods of placing-pumping, spraying; mix design methods; special concrete mixes. Fibre Reinforced Plastics (FRP): advanced polymer composites for structures; polymer matrix materials; fibres used properties of polymers; properties of fibres; structural applications; durability of FRP.

CVEN9825
Continuum Mechanics
Staff Contact: Dr MM Attard
CP15 S1

Tensor algebra and calculus. Curvilinear coordinate systems. Covariant and contravariant components. Tensor invariants. Covariant derivation. Finite deformation. Metric tensor. Stretch and rotation. Strain tensor. Principal strains. Area vector. Stress tensor. Normal and shear stresses. Principal stresses. Equilibrium. Virtual work. Conjugate stress and strain. Constitutive relationships. Boundary value problems. Plasticity.

CVEN9832
Urban Hydrology and Storm Water
Staff Contact: Dr JE Ball
CP15 S1
Excluded: CVEN7800, CVEN7801

Hydrological cycle in the urban environment; anthropogenic impacts on the natural cycle; management of stormwater quantity and quality; information systems for management of stormwater; design of water quality control devices such as gross pollutant traps, booms, wet detention basins; design of water quantity control devices such as detention basins, on-site detention; evaluation of system performance through application of numerical models; case studies; groundwater in urban environments.

CVEN9833
Design of Hydraulic Structures
Staff Contact: A/Prof RJ Cox
CP15 SS

Theory of waterflow in open channels. Application of theory to design of hydraulic structures including spillways, energy dissipators, channel transitions, culverts and side discharge weirs. Environmental control structures also to be considered include sediment and gross pollutant traps, trash racks, pollution booms, reservoir destratification, outfall manifold/diffusers, and fish ladders.

CVEN9835
Coastal Dynamics
Staff Contact: A/Prof RJ Cox
CP15 SS
Excluded: CVEN7802, CVEN7803

Theory of periodic waves as applied to tides and wind generated waves in water of varying depths. Measurement, analysis and prediction of waves and tides. Wave growth, refraction, diffraction, shoaling and breaking.

CVEN9836
Coastal Engineering
Staff Contact: A/Prof RJ Cox
CP15 SS
Excluded: CVEN7804, CVEN7805

Wave forces on coastal and ocean structures with application to practical engineering design of breakwaters, seawalls, piles, decks, marinas and ocean outfalls. Coastal processes, beach morphology, prediction of shoreline

change and coastal zone management. Dredging for navigation, reclamation and beach nourishment.

CVEN9851
Unit Operations in Water and Waste Management
Staff Contact: Mr PJ Bliss
CP15 S1

Theory and principles of physical, chemical and hydraulic unit processes which are common to both water and wastewater treatment; energy dissipation and modelling; mixing; sedimentation; flotation; filtration; aeration; coagulation and flocculation; gas transfer; disinfection; heat transfer; combustion; sludge characterisation, thickening and dewatering; and activated carbon.

CVEN9852
Water and Wastewater Network Design
Staff Contact: Mr PJ Bliss
CP15 SS

Estimation of design population, water demands and variations in flows for municipal water supply. Water supply system components and their design capacities. Hydraulics and design of water distribution systems. Separate sanitary sewer systems – estimation of dry weather flows and their variation; infiltration/inflow estimation and control. Hydraulics and design of sanitary sewers for capacity, self cleansing and sulphide slime control. Design of wastewater pumping installations. Stormwater and combined sewer design.

CVEN9855
Water and Wastewater Analysis and Quality Requirements
Staff Contact: Prof TD Waite
CP15 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.

CVEN9856
Water Treatment
Staff Contact: Prof TD Waite
CP15 S2

Integrated design of facilities for the treatment of various types of raw water to meet specified water quality, with emphasis on water for municipal supply, including: chemical selection, dosing and mixing; coagulation – flocculation – clarification – filtration and disinfection technology. Processes for water softening, iron and manganese removal and demineralisation, including precipitation, oxidation, ion exchange and reverse osmosis. Taste and odour control. Disposal of water treatment residuals.

CVEN9857
Wastewater Treatment
Staff Contact: Mr PJ Bliss
CP15 S2

Principles and applications of aerobic and anaerobic biological processes o treatment of wastewaters and sludges. Design of integrated systems of biological, physical, chemical and sludge treatment processes to satisfy effluent quality objectives. Effluent disposal and reuse. Stabilisation, processing, disposal and utilisation of treatment residuals.

CVEN9858
Catchment and Water Quality Management
Staff Contact: Prof TD Waite
CP15 S2
Excluded: CVEN7806

Fundamental concepts; water policy; total catchment management; rural catchment issues, including salinity, erosion; water quality management in rivers, reservoirs, estuaries and the coastal zone; water quality management within the urban environment including reuse issues.

CVEN9860
Investigation of Groundwater Resources
Staff Contact: Dr RI Acworth
CP15 S1
Excluded: CVEN7807, CVEN7808

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. Unsaturated zone flow and calculation of infiltration. Drilling methods; well design and completion. Contract specification and supervision. Borehole geophysical methods. Solutions to the radial flow equation; pumping test interpretation. Groundwater modelling – finite difference methods. Groundwater recharge mechanisms and water balance calculations; Program of field work and data analysis.

CVEN9861
Environmental and Engineering Geophysics
Staff Contact: Dr RI Acworth
CP15 S2
Excluded: CVEN7809, CVEN7810

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

CVEN9862
Fluvial Hydraulics
Staff Contact: A/Prof RJ Cox
CP15 S2
Excluded: CVEN7811

Unsteady and varied flow in non-uniform channels, secondary currents, sediment transport, channel morphology, scour and shoaling, river control works, modelling of fluvial processes.

CVEN9863
Estuaries and Wetlands
Staff Contact: Dr DA Luketina
CP15 S1
Excluded: CVEN7812, CVEN7813

Classification of estuary and wetland types. The effects of meteorological forcing. Tidal flushing of estuaries and inlets. Mixing processes and modelling the spread of pollutants. Biochemical processes. The use of estuaries and wetlands as receiving waters. Algal modelling. Sedimentation. Data collection.

CVEN9866
Flood Estimation
Staff Contact: A/Prof I Cordery
CP15 S1
Excluded: CVEN7814

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.

CVEN9867
Catchment and River Modelling
Staff Contact: A/Prof I Cordery
CP15 S2
Excluded: CVEN7815, CVEN7816

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

CVEN9871
Water Supply and Sanitation in Developing Regions
Staff Contact: Prof TD Waite
CP15 S1
Excluded: CVEN7817, CVEN7818

Selection of appropriate technology for water supply and wastewater treatment and disposal to account for developing regions and/or remote locations; design basis for systems and the operating requirements; health issues; stormwater and wastewater reuse.

CVEN9872
Solid Waste Management
Staff Contact: Mr SJ Moore
CP15 SS

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

CVEN9875
Hydrological Processes
Staff Contact: A/Prof I Cordery
CP15 S1
Excluded: CVEN7819, CVEN7820

Introduction to hydrological cycle and energy balance: meteorology; precipitation processes and analysis, interception and infiltration, storm runoff processes, evapotranspiration.

CVEN9876
Water Resources Modelling
Staff Contact: Dr A Sharma
CP15 S2
Excluded: CVEN7821, CVEN7822

Water resources data – sources, errors, corrections; introduction to storage-yield relationships for reservoir design; extension of records; stochastic models; stochastic models; use of information systems with water resources data; yield estimations for ungauged catchments; principles of optimal design and operation of water resource systems.

CVEN9880
Groundwater Modelling
Staff Contact: Dr RI Acworth
CP15 SS
Excluded: CVEN7823, CVEN7824

Groundwater modelling of porous media, for porous media for resource management and groundwater contamination studies. Finite difference and finite element methods. Modelling of density dependent fluids and multiphase fluids. Software packages and applications to borefield management and groundwater contamination studies. Workstation and PC based packages will be demonstrated and used.

CVEN9881
Hazardous Waste Management
Staff Contact: Mr SJ Moore
CP15 SS

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.).

CVEN9884
Environmental Engineering Science 1
Staff Contact: Prof TD Waite
CP15 S1
Excluded: CVEN7825, CVEN7826

Application of chemicals principles to aqueous systems; pH and alkalinity, solubility and precipitation, complexation, redox and surface chemistry; chemical equilibrium modelling; introduction to chemical reaction kinetics.

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.

CVEN9885
Environmental Engineering Science 2
Staff Contact: Dr DA Luketina
CP15 S2
Excluded: CVEN7827, CVEN7828

Processes controlling transformation and fate of chemicals in the environment. Measurement and prediction of contaminant behaviour in natural and engineered systems. 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.

CVEN9888
Environmental Management
Staff Contact: Mr SJ Moore
CP15 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 waste audits, Life Cycle Assessment and other materials accounting techniques.

CVEN9889
Environmental Economics and Law
Staff Contact: Mr SJ Moore
CP15 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.

CVEN9890
Spatial Decision Support Systems in Water Resources
Staff Contact: Dr JE Ball
CP15 S2
Excluded: CVEN7829

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.

CVEN9891
Groundwater Contamination and Remediation
Staff Contact: Dr RI Acworth
CP15 S1
Excluded: CVEN7830, CVEN7831

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 contaminated sites. Site remediation: source control, pump and treat, soil vapour extraction, bioremediation.

CVEN9901
Special Topic in Civil Engineering
Staff Contact: School Office
CP15 SS

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

CVEN9902
Special Topic in Civil Engineering
Staff Contact: School Office
CP15 SS

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

CVEN9930
Masters Project
Staff Contact: School Office
CP30 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.

CVEN9940
Special Topics in Civil Engineering
Staff Contact: School Office
CP5 SS

The syllabus and format changes to allow presentation of a special topic of current interest, including a topic covered by an approved short course, and a topic taught by a visitor with recognised expertise in the area.

CVEN9980
Special Topics in Civil Engineering
Staff Contact: School Office
CP10 SS

The syllabus and format changes to allow presentation of a special topic of current interest, including a topic covered by an approved short course, and a topic taught by a visitor with recognised expertise in the area.

School of Computer Science and Engineering

Head of School
Professor PJ Compton

Executive Assistant to Head of School
Dr GR Whale

School Office Manager
Mr CJ 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 and Telecommunications 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 Systems, Information Engineering 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 and Telecommunications, jointly administers the BE Computer Engineering 3645.The BE Software Engineering 3648, which commenced in 1997, is jointly managed with the School of Information Systems. The BE MBiomedE 3728 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), BA and BSocSc, combined BE BSc , combined BSc BA and combined BSc LLB.

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

Bachelor of Engineering	Duration
3645 BE in Computer Engineering	4 years
3648 BE in Software Engineering	4 years
3722 BE BA in Computer Engineering	5 years
3726 BE BSc in Computer Engineering	5 years
3728 BE MBiomedE in Computer Engineering	5 years

Combined BE/BSc in Computer Science	Duration
3725 BE BSc in Electrical Engineering	5 years
3730 BE BSc in Civil Engineering	5 years
3611 BE BSc in Aerospace Engineering	5 years
3661 BE BSc in Manufacturing Management	5 years
3681 BE BSc in Mechanical Engineering	5 years
3701 BE BSc in Naval Architecture	5 years
3746 BE BSc in Geomatic Engineering	5 years

Majors in Computer Science

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)
3930 BSc BA	4 years (Pass)
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				
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	**24**			
Total HPW Session 2	**24**			
Total Credit Points	**120**			
Year 2 (Subject to revision)				
COMP2011	Data Organisation	5	0	15
COMP2021	Digital System Structures	5	0	15
COMP3221	Microprocessors and Embedded Systems	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
ACCT9001	Introduction to Accounting A	1.5	0	7.5
ACCT9002	Introduction to Accounting B	0	1.5	7.5
Total HPW Session 1	**21.0**			
Total HPW Session 2	**22.5**			
Total Credit Points	**137**			

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

		HPW S1	HPW S2	CP
Year 3 (subject to revision)				
COMP3111	Software Engineering	0	5	15
COMP3121	Algorithms and Programming Techniques	0	5	15
COMP3211	Computer Architecture	4	0	15
COMP3231	Operating Systems	5	0	15
ELEC3004	Signal Processing 1	0	4	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		4	0	15
Total HPW Session 1	**23**			
Total HPW Session 2	**26**			
Total Credit Points	**141.5**			

Options A and B are selected from Level III Electrical Engineering or Level III Computer Engineering subjects below. Students must include either COMP3331 or TELE3018 inYear 3 or 4.

		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 the elective lists 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.

Electives

Science Subjects

MATH3411	Information, Codes and Ciphers

Level III Computer Engineering Subjects

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

Level III Electrical Engineering Subjects

ELEC3006	Electronics 2
ELEC3013	Communication Systems 1
ELEC3014	Systems and Control 1
ELEC3016	Electronics 3
ELEC3018	Data Networks 1

Level IV Computer Engineering Subjects

COMP4001	Object-Oriented Software Development
COMP4012	Multimedia Authoring & Cooperative Agent
COMP4141	Theory of Computation
COMP4415	Artificial Intelligence: Foundations
COMP9116	Software System Development
COMP9242	Advanced Operating Systems
COMP9314	Next Generation Database Systems
COMP9416	Knowledge Based Systems
COMP9417	Machine Learning
COMP9315	Database System Implementation
COMP9444	Neural Networks
COMP9514	Advanced Decision Theory for Information Science
COMP9517	Image Processing and Applications

Level IV Electrical Engineering Subjects

ELEC4042	Signal Processing 2
ELEC4303	Electromagnetic Wave Propagation
ELEC4313	Optical Communications
ELEC4323	Digital Modulation and Coding
ELEC4333	Communication Systems 2
ELEC4343	Source Coding and Compression
ELEC4353	Model and Satellite Communication Systems
ELEC4363	Telecommunication Systems
ELEC4483	Biomedical Instrumentation, Measurement abd Design
ELEC4412	Systems and Control 2
ELEC4413	Systems and Control 3
ELEC4503	Electronics 4
ELEC4522	Microelectronics Design and Technology
ELEC4532	Integrated Digital Systems
ELEC4540	Applied Photovoltaics
TELE4352	Data Networks 2

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

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, 3726 and 3728 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 devise 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:
135 credit points, including a major sequence in an approved area

Other Faculties:

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

1. Mathematics or Computer Science majors are not permitted. BE BSc combined degrees are more appropriate for this.

2. Students in the BE BA course are exempt from 15 credit points of General Education. However, if at any time a student reverts to a single degree program, the usual General Education requirements for that course apply.

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

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

5. Students who complete the requirements for their Arts program and the first two years of the BE program may proceed to graduation with the degree of Bachelor of Arts.

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.

Students in the BE BSc course are exempt from 15 credit points of General Education requirements. This exemption is not available to students who withdraw from the combined program and complete only the BE or BSc course.

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)
COMP1011, COMP1021,
ELEC1011,
MATH1131 or MATH1141,
MATH1231 or MATH1241,
MATH1081,
PHYS1969

Year 2
COMP2011, COMP2021, COMP3221,
ELEC2011, ELEC2030, ELEC2033,
MATH2011, MATH2620, MATH2849, MATH3150,
PHYS2959, ACCT9001, ACCT9002

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,
ELEC3013,
MATH2601, MATH3141

Elective subjects in Computer Science and/or Electrical Engineering, General Education, (15 credit points)

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

Physics majors are required to complete PHYS2949 Physics 2E 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):

PHYS2999 Mechanics 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	2.5	0	7.5
SENG1020	Software Engineering Workshop 1B	0	2.5	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	6	0	15
COMP1021	Computing 1B	0	6	15
NFS1603	Business Data Management	3	0	15
INFS1611	Requirements Engineering	1.5	0	7.5
1 elective *		6	0	15
Total HPW Session 1	**25.0**			
Total HPW Session 2	**20.5**			
Total Credit Points	**127.5**			

Note:
* This elective may be a session 1 or session 2 15CP subject from Science, Engineering or Commerce, subject to approval. Recommended subjects include ACCT1501, ECON1101 and PHYS1601.

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
INFS3604	Information Function Management	0	3	15
MATH2859	Statistics for Computing	2.5	0	7.5
General Education subject/s		0	4	15
Total HPW Session 1	**20.5**			
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	5	0	15
*COMP3311	Database Systems or			
*INFS3608	Advanced Database Systems	0	5	15
COMP3331	Computer Networks & Applications	5	0	15
INFS2607	Business Data Networks	0	3	15
General Education subject/s		2	2	15
Total HPW Session 1	**19.5**			
Total HPW Session 2	**17.5**			
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

Postgraduate Study

The formal graduate courses offered in CSE are Master of Computer Science 8680, Master of Information Science 8508, Master of Engineering Science in Computer Science and Engineering 8685, 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 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 of 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 Information Science Program is currently under review. Contact the School Office for information on the Database Management Stream and Internetworking Stream.

8508
Master of Information Science
MInfSc

The MInfSc program involves both course work and 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 six sessions part-time.

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

- Major Project Option: made up of 90 CP of core subjects, and a 90 CP project.
- Course Work Option: made up of 90 CP of core subjects, a 15 CP Networks subject, 45 CP of elective subjects, and a 30 CP project.

Elective subjects may be chosen after consulting the Postgraduate Co-ordinator on the content and credit point value of the subjects.

In the event that approved 12 CP subjects are taken as part of the MInfSc, a minimum of 174 CP must be completed satisfactorily before the award will be granted.

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 usually 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 Postgraduate Co-ordinator.

In the event that approved 12 CP are taken as part of the GradDip in Information Sciencein the University, a minimum of 114 CP must be completed satisfactorily before the award will be granted.

Core Subjects – Information Science Programs

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 Information Systems
   INFS5991 Decision Support Systems
6. GEOG9150 Remote Sensing Applications
   ILAS5110 Information Retrieval Systems
   GMAT9604 Land Information Systems
7. MInfSc students must also complete one subject from:
   COMP9331 Computer Networks and Applications
   ELEC9336 Digital Communication Networks
8. Electives/project if applicable

Graduate Programs in Computer Science

The Master of Computer Science course is a re-training postgraduate course aimed towards graduates who have a four year degree in science or engineering who 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 subjects offered will be continually evaluated for their relevance and currency.

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; eight sessions part-time. MEngSc, two sessions full-time ; four sessions part-time. GradDipCS, three sessions full-time; six sessions part-time.

8685 Master of Engineering Science in Computer Science and Engineering MEngSc

MEngSc in CSE students complete a program of 120 credit points (CP). The program can be completed in two modes:

Course Work Option
8 x 15 CP subjects
or
Course Work and Project Option
5 x 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 distinction average (75%) 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 Postgraduate Co-ordinator.

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: Course work only

Group B & C	max 45 CP
Group D	min 75 CP
Other	–

Mode: Course work 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 subjects from other schools with prior approval from the Postgraduate Co-ordinator. Approved subjects are counted as Group D substitutions.

In the event that an approved 12 CP subject is taken , a minimum of 114 CP must be completed satisfactorily before the award is granted. T

8680 Master of Computer Science MCompSc

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

Course work Option
16 x 15 CP subjects
or
Course work and Project Option
12 x 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 distinction average (75%) in the first 60 CP of subjects attempted (excl Group A); and (b) have obtained approval for their proposed topic from the potential supervisor and the School's Postgraduate Co-ordinator.

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: Course work

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

Mode: Course work 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 subjects from other schools with prior approval from the Postgraduate Co-ordinator. Approved subjects are counted as Group D substitutions.

In the event that an approved 12 CPsubject is taken, a minimum of 234 CP must be completed satisfactorily before the award will be granted.

5452
Graduate Diploma in Computer Science
GradDip

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

Postgraduate subjects in the School 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: Course work only

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

A student may be allowed to take one postgraduate subject from anther school with prior approval from the Postgraduate Co-ordinator. Approved subjects are counted as Group D substitutions.

In the event that an approved 12 CP subject is taken, a minimum of 177 CP must be completed satisfactorily before the award is granted.

Core 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 the MEngSc for credit.

COMP9020	Foundations of Computer Science
COMP9021	Principles of Programming
COMP9022	Digital System Structures
*COMP9023	Functional Programming and Software Development

** Fromm 1999, this subject will be replaced by COMP9024*

Group B

Group B subjects constitute the knowledge in computing that every postgraduate student in computing should possess. Knowledge of many of these subjects is essential before admission to the MEngSc course can be given.

COMP9008	Software Engineering
COMP9101	Design & Analysis of Algorithms
COMP9201	Operating Systems
COMP9221	Microprocessor s and Embedded Systems
COMP9311	Introduction to 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.

COMP9102	Compiling Techniques and Programming Languages
COMP9331	Computer Networks & Applications
COMP9415	Computer Graphics
COMP9511	Human-Computer Interaction
COMP9211	Computer Architecture

Group D

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

COMP4001	Object-oriented Software Development
COMP4012	Mulitmedia Authoring and Co-operative Agents
COMP4141	Theory of Computation
COMP9015	Issues in Computing
COMP9116	Software System Development
COMP9231	Integrated Digital Systems
COMP9242	Advanced Operating Systems
COMP9314	Next Generation Database Systems
COMP9315	Database System Implementation
COMP9332	Advanced Computer Networks
COMP9333	Network Switching and Routers
COMP9416	Knowledge-Based Systems

COMP9417 Machine Learning
COMP9444 Neural Networks
COMP9514 Advanced Decision Theory
COMP9517 Image Processing & Applications
COMP9518 Pattern Recognition
COMP9921 Personal Software Process for Engineers

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 ëHandbook Guide', appearing earlier in this book.

COMP0001
Total Quality Management for Computer Engineering
Staff Contact: Dr T Cowcher
CP7.5 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.

Company visits are undertaken by students to demonstrate the practical application of TQM in both hardware and software design and manufacture.

COMP1011
Computing 1A
Staff Contact: Dr R Buckland
CP15 S1 or S2 L3 T3
Prerequisites: as for MATH1131
Corequisites: 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 (Haskell) for practical experience with these concepts. Introduction to software engineering and professional ethics Lab: programming assignments.

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

Introduction to procedural programming in an object-oriented language (Java). Algorithmic processes: state, sequence, selection, iteration/recursion. Data modelling: atomic types, arrays, classes, inheritance. Data structures: lists, stacks, queues, trees. Algorithms: sorting, searching. Introduction to computer systems architecture. Lab: programming exercises and 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 presentations; 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 WS Matheson
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.

COMP2110
Software System Specification
Staff Contact: A/Prof K Robinson
CP15 S1 HPW 2.5
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: Prof N Foo
CP15 S1 HPW 5

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, skolemisation, 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: Dr J Plaice
CP15 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 J Jin
CP15 S2 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: A/Prof 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 and Implementation
Staff Contact: A/Prof K Robinson
CP15 S1 HPW 5
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 Architecture
Staff Contact: School Office
CP15 S1 L3 T2
Prerequisites: COMP2021 or ELEC2012
Note/s: Excluded COMP9211.

Combinatorial and sequential circuit design and realisation. Arithmetic and logic unit design strategies. Instruction set design: role of performance metrics, RISC vs CISC. Processor design: datapath design, microprogramming, and an introduction to the use of pipelining in enhancing performance. Memory Hierarchy: cache and virtual memory systems. Processor, memory and I/O interface. Testing and design for testability.

COMP3221
Microprocessors and Embedded Systems
Staff Contact: Dr WS 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: A/Prof G Heiser
CP15 S1 L3 T2
Prerequisites: COMP2011, COMP2021
Note/s: Excluded COMP9201.

Operating system organisation and services. Process management: scheduling, synchronisation and communication. Memory management: virtual memory, paging and segmentation, storage management: Disk scheduling, File systems. Protection and security. Distributed operating systems and file systems. Case studies drawn from UNIX, MS-DOS and Mach. Lab. programming assignments.

COMP3311
Database Systems
Staff Contact: Dr J Shepherd
CP15 S2 L3 T2
Prerequisites: COMP2011
Note/s: Excluded COMP9311.

Data models: entity-relationship, relational, object-oriented. Relational database management systems: data definition, query languages, development tools. Database application design and implementation. Architecture of relational database management systems: storage management, query processing, transaction processing. Lab: design and implementation of realistic database application using Oracle, SQL, PL/SQL, Developer 2000.

COMP3331
Computer Networks and Applications
Staff Contact: Dr J Zic
CP15 S1 L3 T2
Prerequisites: COMP2011
Note/s: Excluded COMP9331 and ELEC4352

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 S2 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: School Office
CP15 S2 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. 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: School Office
CP15 S1 L3 T1

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/COMP4012
Occasional Elective S1 or S2 (Computer Engineering)
Staff Contact: School Office
CP15 S1 or S2 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.

COMP4141
Theory of Computation
Staff Contact: A/Prof A Sharma
CP15 S1 L3 T1
Prerequisites: Two Level III Computer Science subjects or equivalent
Note/s: Not offered in 1999.

The subject will cover the fundamentals of computability theory: primitive recursive functions, computable functions, universal programs, undecidability, Church-Turing thesis, Turing machines, recursively enumerable sets, s-m-n theorem, Rice's theorem, Kleene's recursion theorem and alternative models of computation. Additionally, the subject

will also cover detailed material from one of the following sub-areas of theoretical computer science (a) computational complexity theory, (b) computational logic or (c) algorithmic information theory (Kolmogorov complexity theory).

COMP4415
Artificial Intelligence: Foundations
Staff Contact: Prof N Foo
CP15 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
S1 or S2

Students enrolled in courses 3645, 3722, 3726 and 3728 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
Staff Contact: School Office
CP15 S1 or S2

COMP4911
Thesis Part B
Staff Contact: School Office
CP15 S1 or S2

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: Dr J Plaice
CP15 S2 HPW4
Assumed Knowledge: COMP9020 and COMP9021 or COMP2011
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: Prof N Foo
CP15 S1 HPW3
Corequisite: 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: A/Prof A Sharma
CP15 S1 or S2 HPW3
Strict Corequisite: COMP9020
Note/s: Excluded COMP1811, COMP1021.

Introduction to the functional and procedural programming styles. Defining and recognising problem classes. Reasoning about problems: specification, analysis, design and refinement of computing solution. Data types and abstractions. Control structures and functions. Realisation using C language. Data structures: lists, stacks, queue, trees and their applications.

COMP9022
Digital System Structures
Staff Contact: Dr WS Matheson
CP15 S1 HPW3
Corequisite: 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: Prof P Compton
CP15 S1 HPW3
Note/s: Excluded COMP1011, COMP1821. Not offered in 1999 and may be replaced with an elective.

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
Staff Contact: School Office
Note/s: Only offered to students commencing in Session 1, 1999. See School Office for details.

COMP9101
Design and Analysis of Algorithms
Staff Contact: Dr P Maheshwari
CP15 SS HPW3
Assumed Knowledge: 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: A/Prof K Robinson
CP15 S2 HPW3
Corequisite: COMP9020 and COMP9021, or COMP2011
Assumed Knowledge: 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.

COMP9116
Software System Development Using the B-Method and B-Toolkit
Staff Contact: A/Prof K Robinson
CP15 S2 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
Staff Contact: A/Prof G Heiser
CP15 S1 HPW3
Prerequisite: COMP9020, COMP9021 and COMP9022
Note/s: Excluded COMP3231.

Operating system organisation and services. Process management: scheduling, synchronisation and communication. Memory management: virtual memory, paging and segmentation. Storage management: Disk scheduling, file systems. Protection and Security.

Distributed operating systems and file systesm. Case studies drawn from UNIX, MS-DOS, Mach. Lab. programming assignments.

COMP9211
Computer Architecture
Staff Contact: School Office
CP15 S1 HPW4
Assumed knowledge: ELEC2021 or COMP9022
Note/s: Excluded COMP3211.

Combinatorial and sequential circuit design and realisation. Arithmetic and logic unit design strategies. Instruction set design: role of performance metrics, RISC vs CISC. Processor design: datapath design, microprogramming, and an introduction to the use of pipelining in enhancing performance. Memory Hierarchy: cache and virtual memory systems. Processor, memory and I/O interface. Testing and design for testability.

COMP9221
Microprocessor and Embedded Systems
Staff Contact: Dr WS 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. Rigby
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: A/Prof G Heiser
CP15 S2 HPW4
Prerequisite: A minimum average of 65% in COMP9201/ COMP3231 and COMP9211/COMP3211 (quota applies)
Note/s: Excluded COMP4216.

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: Dr X. Lin
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 and ER data models; principles in database design; high level database languages such as relational algebra and SQL; query processing; transaction management and a brief introduction to various advanced databases.

COMP9314
Next Generation Database Systems
Staff Contact: Dr A Ngu
CP15 S2 HPW3
Prerequisite: 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, data warehousing, data mining, client/server systems, Web-based databases.

COMP9315
Database Systems Implementation
Staff Contact: Dr A Ngu
CP15 SS HPW3
Prerequisite: COMP9311
Note/s: Not offered in 1999.

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 S2 HPW3
Assumed knowledge: COMP9020 and COMP9021 or COMP2011
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 W Wilson
CP15 S1 HPW4
Assumed knowledge: COMP9020 and COMP9021 or COMP2011

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 S2 HPW3
Assumed knowledge: Background to final year Computer Science level, equivalent to subjects COMP9020 and COMP9021 or COMP2011

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: Prof P Compton
CP15 S2 HPW3
Assumed knowledge: 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: A/Prof A Sharma
CP15 S2 HPW3
Assumed Knowledge: COMP9414 or COMP3411
Note/s: Excluded COMP4416.

Decision tree learning algorithms (such as C4.5), covering algorithms (such as AQ), instance based learning, case-based learning, nearest neighbour classifiers, genetic algorithms, topics from data mining, inductive logic programming and computational theory learning.

COMP9444
Neural Networks
Staff Contact: A/Prof T. Gedeon
CP15 S1 HPW3
Assumed Knowledge: COMP9020 and COMP9021 or COMP2011
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: School Office
CP15 S2 HPW3

Provides an introduction to user-system interactions, both analysis and design. The approach is cognitive, focusing on matching user goals with computer technologies. 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: A/Prof 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 S1 HPW3
Assumed Knowledge: COMP9020 and COMP9021 or COMP2011

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
CP15 SS HPW3
Prerequisite: COMP9517
Note/s: Not offered in 1999.

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- 30CP Project
Staff Contact: School Office
CP30 S1 or S2 HPW6
Note/s: MInfSc students only

This subject will integrate information science skills obtained in individual information science subjects. The subject will be project oriented with a different project being handled by each student. Project to be submitted on final day of session.

COMP9912
Project Report
Staff Contact: School Office
CP60 S1 or S2
Note/s: MCompSc students only
see COMP9945 for description

COMP9918
Project Report
Staff Contact: School Office
CP90 S3
Note/s: MInfSc students only
see COMP9945 for description

COMP9921
Personal Software Process for Engineers
Staff Contact: A/Prof A Sharma
CP15 S1 HPW3
Assumed Knowledge: COMP1021, COMP2011 and background in statistics

This subject introduces elements of a disciplined software process for software engineers. Topics covered include planning, software size estimation, resource and schedule estimation, measurement, quality control in software development, design reviews, code reviews, inspections, economics of software quality, yield and use of design templates in defect prevention. These topics are illustrated via Watts Humphrey's Personal Software Process- a CMM Level 5 process for individual engineers. The students will be required to follow the process learned in ten programming assignments and two reports.

COMP9945
Project Report
Staff Contact: School Office
CP45 S1 or S2
Note/s: MEngSc students only

COMP9918, COMP9912 and COMP9945 are programs 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
CP15 S1 HPW 2.5
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
CP15 S2 HPW 2.5
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
CP15 S1 HPW 2.5
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: School Office
CP15 S2 HPW 2.5
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
CP15 S1 HPW 2.5
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
CP15 S2 HPW 2.5
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
CP15 S1 HPW 4
Note/s: Not offered in 1999

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
CP15 SS HPW 7

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
CP30 SS HPW 14
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 and Telecommunications

Head of School
Professor BG Celler

Director of Academic Studies
Professor T Hesketh

Senior Administrative Officer
Ms KM Mason

Administrative Officer
Miss AGM Johnson

The School comprises four departments and a Special Research Centre: Telecommunications (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. The Australian Photonics Co-operative Research Centre conducts research into Optical Fibre communication devices and technology.

Electrical Engineering and Telecommunications 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 and telecommunications. 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
3643 BE in Telecommunications	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

Options within Electrical Engineering include: Communication Systems, Computer Systems, Control Systems, Electric Power, Electronics, Photovoltaics, Signal Processing. 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 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	2	0	7.5
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	4	15
PHYS1969	Physics 1	6	6	30
Total HPW Session 1		**23**		
Total HPW Session 2		**24**		
Total Credit Points		**127.5**		

		HPW S1	HPW S2	CP
Year 2				
COMP1021	Computing 1B	6	0	15
ELEC2015	Electromagnetic Applications	0	3	9
ELEC2031	Circuits and Systems	3	3	15
ELEC2033	Electronics 1	0	4	12
ELEC2041	Microprocesses and Interfacing	4	0	12
ELEC2042	Real Time Instrumentation	0	4	12
MATH2011	Several Variable Calculus	4	0	12
MATH2620	Higher Complex Analysis	0	2.5	7.5
MATH2520	Complex Analysis	0	2.5	7.5
MATH2849	Statistics EE	0	3	9
PHYS2949	Physics 2E	6	0	15
General Education subject/s		0	4	15
Total HPW Session 1		**23.5**		
Total HPW Session 2		**23.5**		
Total Credit Points		**133.5**		

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	0	4	12
ELEC3005	Electrical Energy 1	4	0	12
ELEC3006	Electronics 2	5	0	12.5
ELEC3013	Communication Systems 1	4	0	12
ELEC3014	Systems and Control 1	0	4	12
ELEC3017	Electrical Engineering Design	0	5	12.5
MATH2501	Linear Algebra	5	0	12.5
MATH3150	Transform Methods	0	2	7.5
General Education subject/s		2	2	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:

		HPW S1	HPW S2	CP
Group A				
ELEC3015	Electrical Energy 2	0	4	12
ELEC3016	Electronics 3	0	4	12
ELEC3018	Data Networks 1	0	4	12
ELEC3041	Real Time Engineering	4	0	12
MATH3141	Mathematical Methods EE	0	4	12
Group B (Technical elective)				
COMP2011	Data Organisation	0	5	15
ELEC3402	Introductory Physiology for Engineers	4	0	12
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		**23**		
Total Credit Points		**132**		

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.

		HPW S1	HPW S2	CP
Year 4				
5 Professional Electives		12	8	60
ELEC4010	Introduction to Management for Electrical Engineers	4	0	12
ELEC4011	Ethics and Electrical Engineering Practice	0	2	6
ELEC4903	Industrial Training	0	0	7.5
ELEC4910	Thesis Part A	6	0	15
ELEC4911	Thesis Part B	0	12	30

Total HPW Session 1 22
Total HPW Session 2 22
Total Credit Points 124.5

ELEC4914 Thesis Project Part A and ELEC4915 Thesis Project Part B.

The Project is carried out in the last two sessions of the BE degree course for full time students with a weighted average of less than 63 at the end of Year 3, and others who elect to take the Project in preference to the Thesis. Five hours per week in the first session and ten hours per week in the second session are devoted to directed laboratory work on an approved project under the guidance of a member of the lecturing staff. Part time students may need to attend the university full time in the final session, or attend for one further part time session if they cannot otherwise make arrangements to participate in group activities. Generally the project involves team work in carrying out graduated laboratory and design exercises, aimed at emulating project work that might be encountered by a newly graduated engineer in a project team, and to meet a stated group objective. Each group will produce a full set of specifications for their designs (user, design, test), and report the final results of tests which indicate the specifications are met. Students will form groups of 10-15, and will be required to allocate work to each member of the group to carry out the various design objectives. Each student is required to participate in presentations to the group at regular meetings. The group will present a seminar as part of the requirements for ELEC9414, Project Part A. Satisfactory performance in ELEC4914 is a prerequisite for progress to subject ELEC4915. A written project report must be submitted by each member of a group by the Tuesday of the 14th week of the second session of enrolment to satisfy the requirements for ELEC4915, Project Part B. The group will engage in an Open Day Project Demonstration.

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

3643
Telecommunications Engineering

		HPW S1	HPW S2	CP
Year 1				
COMP101	Computing 1A	0	6	15
TELE1010	Introduction to Telecommunications	3	0	7.5
ELEC1011	Electrical Engineering 1	6	0	15
ELEC1041	Digital Circuits	0	4	15
MATH1131	Mathematics 1A	6	0	15
MATH1231	Mathematics 1B	0	6	15
MATH1090	Discrete Mathematics	0	3	7.5
PHYS1969	Physics 1	6	6	30
		20	**25**	**120**
Year 2				
COMP1021	Computing 1B	6	0	15
ELEC2031	Circuits and Systems	3	3	15
ELEC2015	Electromagnetic Theory & Applications	3	3	15
ELEC2033	Electronics 1	0	6	15
ELEC2041	Microprocessors and Interfacing	4	0	15
ELEC2042	Real Time Instrumentation	0	4	15
MATH2011	Several Variable Calculus	4	0	15
MATH2620	Higher Pure Mathematics 2 - Complex Analysis or			
MATH2520	Pure Mathematics 2 - Complex Analysis	0	2.5	7.5
	General Education Elective	2	2	15
		22	**20.5**	**127.5**
Year 3				
ELEC3004	Signal Processing 1	0	5	15
TELE3006	Telecommunications Electronics	3	0	7.5
TELE3013	Telecommunication Systems	15	0	15
ELEC3017	Electrical Engineering Design	0	5	15
TELE3018	Data Networks 1	0	5	15
ELEC3041	Real Time Engineering	5	0	15
MATH3150	Transform Methods	2	0	7.5
MATH3590	Linear Algebra (Telecommunications)	3	0	7.5
General Education		2	2	15
1 Elective from:				
ELEC3005	Electrical Energy 1	5	0	15
ELEC3014	Systems \& Control 1	0	5	15
ELEC3016	Electronics 3	0	5	15
MATH3141	Numerical \& Mathematical Methods	0	4	15
COMP2011	Data Organisation	0	5	15
ELEC3402	Introductory Physiology for Engineers	5	0	15
MATH2849	Statistics EE	0	4	15
		20	**22**	**127.5**

		HPW S1	HPW S2	CP
Year 4				
	3 Professional Electives	8	4	45
ELEC4010	Introduction to Management for Electrical Engineers	4	0	15
ELEC4011	Ethics and Electrical Engineering Practice	0	2	7.5
TELE4363	Telecommunication Systems	24	0	15
TELE4903	Industrial Training	0	0	0
TELE4910	Thesis Part A	6	0	15
TELE4911	Thesis Part B	0	12	30
		22	18	127.5

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
ELEC4323	Digital Modulation and Coding	12
ELEC4333	Communication Systems 2	12
ELEC4343	Source Coding and Compression	12
ELEC4352	Data Networks 2	12
ELEC4353	Mobile and Satellite Communication Systems	12
ELEC4363	Telecommunications Systems	12
ELEC4412	Systems and Control 2	12
ELEC4413	Systems and Control 3	12
ELEC4483	Biomedical Instrumentation, Measurement and Design	12
ELEC4503	Electronics 4	12
ELEC4522	Microelectronics Design and Technology	12
ELEC4532	Integrated Digital Systems	12
ELEC4540	Applied Photovoltaics	12
COMP3111	Software Engineering	15
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 Telecommunications 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, need to 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 and Telecommunications.

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 and Telecommunications. 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 and Telecommunications.

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 and Telecommunications 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 and Telecommunications.

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,
ELEC2031, ELEC2015, 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.

Mathematics majors should do the Higher Mathematics subjects.

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

Year 3
ELEC3004, ELEC3005, ELEC3006, ELEC3013,
ELEC3014, ELEC3017,
MATH2601, MATH3150

Two subjects from Groups A and B, with a maximum of one subject from Group B.
Group A: ELEC3015, ELEC3016, ELEC3018,
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 105 credit points at Level II or Level III including at least 60 credit points of Computer Science subjects at Level III with the balance being chosen from Level III Computer Science subjects and other Level II or Level III subjects from the Science Program 0600. (COMP2031 is the balance of 120 credit points).

Mathematics
Choose at least 75 credit points of Mathematics subjects, 60 of which are Level III.

Choose at least 45 credit points of Level II or Level III subjects from the Science Program 1000.

Physics
Choose another 105 credit points of Level II or Level III subjects of which at least 60 credit points must be Level III Physics subjects chosen to include PHYS3010 or PHYS3210, PHYS3021, PHYS3030, PHYS3230 or PHYS3060. (PHYS2999 is the balance of 120 credit points).

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.

Postgraduate 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.

Coursework 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 and Telecommunications: each Program Coordinator 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 Coordinator: Dr H. Mehrpour
Programs:
1. Communication Electronics
2. Digital Communication and Systems
3. Microwave and Optical Communications
4. Signal Processing

Electric Power

Program Coordinator: A/Prof T.R. Blackburn
Programs:
1. Power Systems Engineering
2. Electrical Power Technology
3. Electrical Energy Systems

Electronics

Program Coordinator: A/Prof C.Y. Kwok
Programs:
1. Solid State Devices
2. Microelectronics
3. Photovoltaics

Systems and Control

Program Coordinator: Professor N.W. Rees
Programs:
1. Digital Systems and Control
2. Cybernetic Engineering and Advanced Robotics
3. Biomedical Engineering (see coordinator)

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 75 credit points from the Communications area (a 30 credit point project and 45 credit points of coursework or 75 credit points of coursework within one of the following programs).

1. Communication Electronics
One elective subject may be chosen from outside this program.

		CP
Core subject		
ELEC9340	Communication Electronics	15
Elective subjects		
COMP9215	VLSI System Architecture and Design	15
COMP9221	Microprocessor Systems	15
ELEC9338	Television and Video Signal Processing	15
ELEC9341	Signal Processing 1 – Fundamental Methods	15
ELEC9343	Principles of Digital Communications	15
ELEC9353	Microwave Circuits: Theory and Techniques	15

ELEC9354	Microwave and Optical Devices	15
ELEC9403	Real Time Computing and Control	15
ELEC9503	Integrated Circuit Design	15

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	15
ELEC9337	Data Networks	15
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

ELEC9350	Theory of Optical Fibres and Optical Signal Processing	15
ELEC9351	Propagation and Transmission of Electromagnetic Waves	15
ELEC9354	Microwave and Optical Devices	15

Elective subjects

ELEC9352	Antenna Design and Applications	15
ELEC9353	Microwave Circuits: Theory and Techniques	15
ELEC9355	Optical Communications Systems	15

4. Signal Processing
One of the four elective subjects may be chosen from outside the program.

Core subjects

ELEC9341	Signal Processing 1 – Fundamental Methods	15
ELEC9342	Signal Processing 2 – Advanced Techniques	15

Elective subjects

ELEC9340	Communication Electronics	15
ELEC9343	Principles of Digital Communications	15
ELEC9350	Theory of Optical Fibres and Optical Signal Processing	15
ELEC9370	Digital Image Processing Systems	15
ELEC9338	Television and Video Signal Processing	15

Electric Power

Normally 90 credit points of coursework and a 30 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

ELEC4215	Industrial Electrical Systems	15
ELEC9201	Power System Planning and Economics	15
ELEC9202	Power Systems Operation and Control	15
ELEC9203	Power System Analysis	15
ELEC9204	Protection of Power Apparatus and Systems	15
ELEC9223	Power Engineering Seminars	15

2. Electrical Power Technology

COMP9221	Microprocessor Systems	15
ELEC4215	Industrial Electrical Systems	15
ELEC9204	Protection of Power Apparatus and Systems	15
ELEC9214	Power System Equipment	15
ELEC9231	Electrical Drive Systems	15
ELEC9223	Power Engineering Seminars	15
ELEC9226	Electrical Services in Buildings	15

3. Electrical Energy Systems

COMP9221	Microprocessor Systems	15
ELEC9201	Power System Planning and Economics	15
ELEC9202	Power System Operation, Control and Planning	15
ELEC9223	Power Engineering Seminars	15
ELEC9226	Electrical Services in Buildings	15
ELEC9504	Solar Energy Conversion	15
ELEC9507	Solar Cells and Systems	15
ELEC9221	Special Topic in Power	15

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 and Telecommunications 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	15
ELEC9401	Computer Control Systems 1	15
MANF9400	Industrial Management	15
MECH9720	Solar Energy	15
SAFE9213	Introduction to Safety Engineering (M)	15

Electronics

Normally 90 credit points of coursework and a 30 credit point 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 Coordinator, 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	15
ELEC9501	Advanced Semiconductor Devices	15
ELEC9502	Integrated Circuit Technology	15
ELEC9504	Solar Energy Conversion	15
ELEC9507	Solar Cells and Systems	15
ELEC9509	Photovoltaics	15

2. Microelectronics

COMP9215	VLSI Systems Architecture Design	15
ELEC9340	Communication Electronics	15
ELEC9501	Advanced Semiconductor Devices	15
ELEC9502	Integrated Circuit Technology	15
ELEC9503	Integrated Circuit Design	15

Additional elective subjects for programs 1 and 2:

COMP9221'	Microprocessor Systems	15
ELEC4240	Power Electronics	12
ELEC4532	Integrated Digital Systems	12
ELEC9341	Signal Processing 1 – Fundamental Methods	15
ELEC9342	Signal Processing 2 – Advanced Techniques	15
ELEC9343	Principles of Digital Communications	15
ELEC9353	Microwave Circuits: Theory and Techniques	15

3. Photovoltaics

ELEC9501	Advanced Semiconductor Devices	15
ELEC9502	Integrated Circuit Technology	15
ELEC9504	Solar Energy Conversion	15
ELEC9507	Solar Cells and Systems	15
ELEC9508	High Efficiency Silicon Solar Cells	15
ELEC9509	Photovoltaics	15

Additional electives for program 3:

COMP9221	Microprocessor Systems	15
ELEC4240	Power Electronics	12
ELEC9201	Power System Planning and Economics	15
ELEC9202	Power System Operation, Control an5 Planning	15
MECH9720	Solar Thermal Energy Design	15
	Design	15
SAFE9213	Introduction to Safety Engineering	15

Systems and Control

1. Digital Systems and Control

All coursework or 90 credit points of course work and a 30 credit point project. 30 credit point projects are subject to the availability of a suitable supervisor.

Core subjects

ELEC9401	Computer Control Systems 1	15
ELEC9402	Computer Control Systems 2	15
ELEC9403	Real Time Computing and Control	15
ELEC9404	Topics in Digital Control	15

Elective subjects

COMP9221	Microprocessor Systems	15
ELEC9342	Signal Processing 2 – Advanced Techniques	15
ELEC9405	Advanced Control Topics	15
ELEC9410	Robotics, Automation and Productivity Technology	15
ELEC9415	Optimisation and Optimal Control	15
ELEC9416	Non-Linear Systems and Simulation	15

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	15
ELEC9409	Cybernetic, Machine and Robot Vision	15
ELEC9410	Robotics, Automation and Productivity Technology	15

Elective subjects

COMP9221	Microprocessor Systems	15
ELEC9342	Signal Processing 2 – Advanced Techniques	15
ELEC9370	Digital Image Processing Systems	15
ELEC9403	Real Time Computing and Control	15
ELEC9405	Human Movement Control Systems	15

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 10 credit points each)	60
Project	ELEC9930 Project Report	30
Total:		90

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 30 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 and Telecommunications. 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. Graduate Diploma program requires completion of 90 credit points by coursework only

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

CP10 S2 L2 T2

Prerequisite: PHYS1002 or equivalent (eg PHYS1918 or PHYS2920

Circuit theory: analysis and design of DC and AC circuits, comprising various energy sources and complex impedances, 3 phase circuits. Laboratory methods: electrical safety, transformers and power supplies, signal generators, measuring devices, oscilloscopes. Digital logic: combinational logic, memory, sequential logic and statemachines, programmable logic devices. Instrumentation: operational amplifiers, sensors, simple signal processing, data transmission, A/D/A conversion. AC machines and induction motors. DC machines and motors.

ELEC0808

Electrical Engineering 2E

Staff Contact: Dr BD 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.

ELEC0809

Electrical Engineering 1C

Staff Contact: Dr B. D. Farah

CP5 L1.5 T0.5

Excluded: ELEC0807

Prerequisite: PHYS1002 or equivalent (eg. PHYS1918 or PHYS2920).

Circuit theory: analysis and design of DC and AC circuits, comprising various energy sources and complex impedances, 3-phase circuits, frequency response. Laboratory methods: electrical safety, signal generators, measuring devices, oscilloscopes. Transformers and power supplies. AC machines and induction motors. DC machines and motors.

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 and Telecommunications.

ELEC1010

Introduction to Electrical Engineering

Staff Contact: A/Prof HR Outhred

CP7.5 S1 L1 T1

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. Verbal and written communication and inter-personal skills in engineering.

ELEC1011
Electrical Engineering 1
Staff Contact: Dr EH Fooks, Dr R Ramer
CP15 S1 or S2 L3 T3
Corequisite: PHYS1969 or equivalent

Passive electrical components. Electric circuit concepts and relationship to field theory. Kirchhoff'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 DJ Clements
CP15 S2 L2 T2
Prerequisites: ELEC1011
Excluded: ELEC2012, COMP2021

Realisations of combinational circuits: MSI devices, ROM's. PLA's. synchronous. sequential logic circuits: latches, flip flops, counters, registers. Algorithmic state machines: systematic design procedures. A Synchronous ssequential logic circuits, design applications. PLD's

ELEC2011
Systems Theory
Staff Contact: Dr DJ Clements
CP6.5 S2 L2 T5
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/Dr I M Skinner
CP6.5 S2 L2 T.1
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. Some health and regulatory considerations.

ELEC2030
Circuit Theory
Staff Contact: Dr KC 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.

ELEC2031
Circuits and Systems
CP15 S3 HPW3

Revision of basic circuit theory; RLC circuits; sinusoidal circuit response; mutual inductance and transformers; operational amplifiers; computer aided circuit design; state space circuit representations and time responses; homogenous and particular solutions for first and second order linear differential equations; computer aided analysis of signals and systems; discrete time signals and systems, including state space representations; continuous time signals, sinusoids and signal norms; convolution, impulse and step responses; phasors; AC circuits (transient and steady state responses); complex power; frequency responses of circuits and systems; three-phase circuits.

ELEC2033
Electronics 1
Staff Contact: A/Prof SR Wenham
CP10 S2 L2 T2
Co-requisites: ELEC2031
Note/s: Excluded ELEC2020.

Operating principles and terminal characteristics of PN diodes, solar cells, bipolar and field effect transistors, Analysis and design of low-frequency single stage and multistage class A amplifiers, including choice of biasing method. Consideration is given to stability, feedback, impedence 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 WS Matheson
CP10 S1 L2 T2
Prerequisites: COMP1011, ELEC1041
Corequisite: 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: A/Prof T Hesketh
CP10 S2 L2 T2
Prerequisites: ELEC1041, ELEC2041, or MECH3202

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 DJ Clements/Dr IM Skinner
CP10 S2 L2 T2
Prerequisites: ELEC2031, 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 realisations 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 realisation 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: A/Prof CY Kwok
CP12.5 S1 L3 T2
Prerequisite: ELEC2033
Note/s: Excluded ELEC3011, ELEC3031

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: Dr GD Peng
CP10 S1 L2 T2
Prerequisites: ELEC2031, MATH3150

To present a general introduction to telecommunications in the form of an overview of signal acquisition, transmission and processing in communication systems. This subject is intended for electrical or computer engineering students not specialising in telecommunications and also as a necessary background for those intending to specialise. Overview of major communication systems (telephony, radio and TV, radar, navigation, etc.). Major signal types and their characteristics (speech, audio, video, data). Characteristics of typical communication channels. Methods of handling various channel problems (modulation, diversity, coding, etc.). Propagation and antennas. Basic analogue and digital modulation methods. Data modems and standards, ISDN. Introduction to data networks.

ELEC3014
Systems and Control 1
Staff Contact: A/Prof PD Neilson
CP10 S2 L2 T2
Prerequisite: ELEC2031

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 utilisation of electrical energy, with some emphasis on contemporary aspects of

energy utilisation, 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).

Utilisation 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.

Utilisation 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 Honsberg
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 Design
Staff Contact: A/Prof WH Holmes
CP12.5 S2 L2 T3
Prerequisite: ELEC2042, ELEC3006

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.

ELEC3018
Data Networks 1
Staff Contact: Dr WJ Dewar
CP10 S2 L3 T1
Prerequisites: ELEC3013
Note/s: Excluded ELEC4351

This subject provides an understanding of the technologies and network architectures surrounding telecommunications. It outlines the two most common telecommunication technologies – Circuit Switching (telephony) and Packet Switching (data) networks and identifies the specific applications (services) which use them. It also describes the advantages and disadvantages of each of these techniques in terms of qualify of service (QOS), flexibility and cost.

Telecommunication systems from the network perspective. The OSI/ISO reference model. Evolution of the telephone system architecture. Digital switching and multiplexing. Packet switching. Traffic engineering. Flow and congestion control. Network management. Network security. Speech, video and data compression. Internetworking. TCP/IP reference model. LANs, MANs and FDDIs.

ELEC3041
Real Time Engineering
Staff Contact: A/Prof T Hesketh
CP10 S1 L2 T2
Prerequisite: ELEC2042 or MECH3202

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 Realisation: controller structures; implementation of continuous and discrete controllers; robustness issues; programmable logic controllers.

Networks; coding; serial data transmission; modems, layered protocols; standards; simple LANs.

ELEC3402
Introductory Physiology for Engineers
Staff Contact: Prof BG 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 GA Rigby
CP12 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 HR Outhred
CP6 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: A/Prof WH Holmes
CP12 S1 L2 T2
Prerequisite: ELEC3004, MATH3150

Advanced 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: Dr RJ Kaye
CP12 S1 L2 T2
Prerequisite: ELEC3005
Note/s: Excluded: ELEC4202, ELEC4215

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/A/Prof M F Rahman
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 and analysis.

ELEC4240
Power Electronics
Staff Contact: A/Prof FM Rahman
CP12 S1 L2 T2
Prerequisite: ELEC2003 and MATH3150

Modern power semicondutor devices eg, diodes, thyristors, mosfets, and other insulated gate devices such as the IGBT, MCT and the FCT; Static and switching characteristics, gate drive and protection techniques; Various DC-DC, AC-DC, DC-AC and AC-AC converter circuit topologies, their characteristics and control techniques; Application considerations for remote and uniterruptible power supplies, and for computer systems, telecommunications, automobiles, traction and other industrial processes; Utility interaction, harmonic distortion, and power factor; EMI and EMC considerations.

ELEC4313
Optical Communications
Staff Contact: A/Prof PL Chu
CP12 S1 L2 T2
Pre-requisites: ELEC3013
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.

ELEC4323
Digital Modulation and Coding
Staff Contact: A/Prof TB Vu
CP12 S1 L2 T2
Prerequisite: ELEC3013

A specialist subject, designed to provide detailed knowledge of techniques used to process digital information in order to ensure its reliable delivery via a noisy channel. It will also provide methods of estimating the degree of reliability under a given transmission condition. Finally, it provides a general understanding of the role of digital modulation and coding in practical digital communication systems.

Brief review of sampling theory and source coding. Digital transmission through AWGN channels. Baseband signalling and pulse shaping. Channel equalisation. Synchronisation. Line coding. Transmission via carrier modulation. Channel capacity. Forward error correction coding. Spread spectrum. Applications of these techniques in typical digital communications systems.

ELEC4333
Communications Systems 2
Staff Contact: A/Prof TB Vu
CP12 S2 L2 T2
Prerequisites: ELEC2015, ELEC3013

This subject provides a fundamental coverage of important communication systems, their basic components, as well as legal and commercial aspects affecting the design and operation of these systems. This subject is intended for students who wish to major in telecommunications or to strengthen their knowledge of modern communication systems. Basic principles of guided and unguided wave propagation. Antenna radiation. Active microwave devices. Radar and navigation systems. Broadcast radio and TV systems. Cable systems. Introduction to mobile and satellite communications.

ELEC4343
Source Coding and Compression
Staff Contact: A/Prof. WH Holmes
CP12 S2 L3 T1
Prerequisites: ELEC3004, ELEC3013

To present a comprehensive overview of source coding and signal compression, which is an essential and increasingly important component of modern digital communication and multimedia systems. This subject is aimed particularly at electrical or computer engineering students majoring in telecommunication or multimedia applications.

Characteristics of analogue information sources (speech, audio, images, video). Sampling methods. Scalar and vector quantisation. Information and entropy, rate-distortion and quantisation analysis. Lossless coding methods. Lossy coding – reducing redundancy, removing irrelevance, quality measures. Basic waveform coding methods (PCM, DM, DPCM, etc.). Advanced waveform coding methods in one and two dimensions (e.g. transform, subband and predictive coding). Non-waveform coding, including vocoders and frequency domain methods. Major coding methods and standards for speech, audio, images and video. Real time transmission of speech, audio and video in telecommunication systems, including digital circuit multiplication and variable bit rate coding.

ELEC4352
Data Networks 2
Staff Contact: Dr H Mehrpour
CP12 S2 L2 T2
Prerequisite: ELEC3018

This subject provides insight into how to design, analyze and evaluate performance of the telecommunication networks. The subject identifies the benefits of high speed networks such as effectiveness, cost and customer control. It also describes the functions and characteristics of several services and technologies, including Personal Communication Services (PCs), Frame Relay, Asynchronous Transfer Mode (ATM), SONET/SDH and Switched Multimegabit Data Services (SMDS).

Protocol modelling and verification techniques. Asynchronous Transfer Mode (ATM). ATM LANs, multimedia communication. Analysis of protocols for data link, network and transport layers. Network design. Frame Relay. Switched Multimegabit Data Services (SMDS). Operating system views of communication.

ELEC4353
Mobile and Satellite Communication Systems
Staff Contact: A/Prof TB Vu
CP12 S2 L2 T2
Prerequisite: ELEC4323

A specialist subject, aimed to provide a fundamental understanding of the system architecture and system design, and the effect of the channel on the performance of two of the most important digital telecommunications systems, i.e. digital cellular mobile communication and digital satellite communication. It shows how digital modulation and coding techniques taught in ELEC4323 Digital Modulation and Coding may be used to improve the reliability of each system. It also provides a general understanding of these systems from the network perspective.

Modern communication systems from a systems point of view. Cellular mobile communication systems. Propagation-loss model. The mobile fading channel. Multiple access techniques. The GSM. Digital satellite communication systems. Satellite orbits. Station keeping. Multiple access techniques. System synchronisation. DAMA. Satellite packet communication. Mobile satellite networks.

ELEC4363
Telecommunications Systems
Staff Contact: Dr WJ Dewar
CP12 S2 L3 T1
Prerequisite: ELEC3018

A specialist subject, aimed at providing a fundamental understanding of the design and operation of modern telecommunication systems. Modern telecommunication

networks from a systems point of view. Evolution of telecommunication systems. Analogue versus digital networks. Multiplexing schemes including SONET and SDH. ISDN and ATM-based B-ISDN. Frame relay and cell relay. Digital switching concepts. Circuit switching and packet switching. ATM switches. Signalling systems. Traffic engineering. Network security and management. Network planning and design. Telecommunications regulations and standards.

ELEC4412
Systems and Control 2
Staff Contact: Prof NW 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 course covers: process modelling, root locus and frequency response design, classical PID control, discrete control continuous and discrete state space analysis, state variable feedback, pole placement and optimal control, robust control, nonlinear systems.

ELEC4413
Systems and Control 3
Staff Contact: Dr G Feng
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; simple loop shaping; internal models and model following; Aspects of implementation are constantly emphasised.

ELEC4483
Biomedical Instrumentation, Measurement and Design
Staff Contact: Prof BG 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.

ELEC4503
Electronics 4
Staff Contact: Prof GA 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.

ELEC4522
Microelectronics Design and Technology
Staff Contact: A/Prof CY Kwok
CP12 S1 L2 T2
Prerequisite: ELEC3006

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/SRAM. Yield, reliability, failure analysis techniques and packaging. The laboratory program is aimed at understanding the internal design of some standard IC functions.

ELEC4532
Integrated Digital Systems
Staff Contact: Prof GA Rigby
CP12 SS L2 T2
Prerequisites: ELEC1041 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 SR 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: School Office

Students enrolled in courses 3640, 3643, 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 organisations, ii) to understand the rÙle 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 summarise the actual technical work carried out and include a brief description of the company and its organisation 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: School Office
CP15 S1 or S2 HPW5
Corequisite: ELEC3017

ELEC4911
Thesis Part B
Staff Contact: School Office
CP30 S1 or S2 HPW10
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.

ELEC4914
Thesis Project Part A
CP15 S1 and S2 HPW5

and

ELEC4915
Thesis Project Part B
CP30 S1 and S2 HPW10

The Project is carried out in the last two sessions of the BE degree course for full time students with a weighted average of less than 63 at the end of Year 3, and others who elect to take the Project in preference to the Thesis. Five hours per week in the first session and ten hours per week in the second session are devoted to directed laboratory work on an approved project under the guidance of a member of the lecturing staff. Part time students may need to attend the university full time in the final session, or attend for one further part time session if they cannot otherwise make arrangements to participate in group activities. Generally the project involves team work in carrying out graduated laboratory and design exercises, aimed at emulating project work that might be encountered by a newly graduated engineer in a project team, and to meet a stated group objective. Each group will produce a full set of specifications for their designs (user, design, test), and report the final results of tests which indicate the specifications are met. Students will form groups of 10-15, and will be required to allocate work to each member of the group to carry out the various design objectives. Each student is required to participate in presentations to the group at regular meetings. The group will present a seminar as part of the requirements for ELEC9414, Project Part A. Satisfactory performance in ELEC4914 is a prerequisite for progress to subject ELEC4915. A written project report must be submitted by each member of a group by the Tuesday of the 14th week of the second session of enrolment to satisfy the requirements for ELEC4915, Project Part B. The group will engage in an Open Day Project Demonstration.

ELEC9201
Electricity Industry Planning and Economics
Staff Contact: A/Prof HR Outhred and Dr RJ Kaye
CP15

Objectives for the energy sector and the electricity industry. Trends towards implementing competition. 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 RJ Kaye
CP15

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. Operations in the spot market:bidding and market clearing, dispatch and commitment, storage operation. Renewable energy systems.

ELEC9203
Power System Analysis
Staff Contact: Dr RJ Kaye
CP15 S2
Prerequisite: Assumed knowledge ELEC4205 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 TR Blackburn
CP15
Prerequisite: Assumed knowledge ELEC9213 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. Busbar 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 TR Blackburn
CP15
Prerequisite: Assumed knowledge ELEC4205 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 TR Blackburn
CP15

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 TR Blackburn
CP15

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 TR Blackburn
CP15

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 HR Outhred
CP15

Weekly seminars given by members of the staff, postgraduate students and outside 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 TR Blackburn
CP10

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 TR Blackburn

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 TR Blackburn
CP15
Prerequisite: Assumed Knowledge: ELEC3015, ELEC4205

Principles, standards and current technology involved in the provision of electrical services in large buildings. Distribution systems - types of transformers. Wiring/Cabling including data and telecoms. Protection: overcurrent and

overvoltage. Voltage considerations. Lighting Design. Subsystem 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
CP15
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 and analysis. Slip power recovery schemes for induction motor drives. Vector controlled induction motor drives. Brushless DC drives. The analysis of asymmetrically connected induction motors, unified machine theory.

ELEC9330
Special Topic
Staff Contact: Dr H Mehrpour
CP15

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 TB Vu
CP15
Note/s: Excluded ELEC9337, ELEC4351, ELEC4352, ELEC3018.

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: frame relay and cell relay.

ELEC9337
Data Networks 2
Staff Contact: Dr H Mehrpour
CP15
Prerequisite: ELEC3018.

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: School Office
CP15
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: School Office
CP15
Prerequisite: Assumed knowledge ELEC3013, ELEC3016 or similar

Electronic aspects of modern analogue and digital communication systems. Topics selected from: electronic system noise; analogue modulators, demodulators, frequency conversion circuits, AM and FM transmitters and receivers; television electronics; phase locked loops; switched capacitor and other practical filter technologies; surface acoustic wave devices.

ELEC9341
Signal Processing 1 – Fundamental Methods
Staff Contact: A/Prof WH Holmes
CP15
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 realisation; 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: A/Prof WH Holmes
CP15
Prerequisite: 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. equalisation, echo cancellation, noise reduction , deconvolution).

ELEC9343
Principles of Digital Communications
Staff Contact: School Office
CP15
Prerequisite: ELEC1041 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: A/Prof TB Vu
CP15
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, equalisation; partial response, full response and Nyquist signals; complexity and comparisons.

ELEC9350
Theory of Optical Fibres and Optical Signal Processing
Staff Contact: Prof PL Chu
CP15

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 equalisation. Measurement of fibre characteristics. Optical sensors.

ELEC9351
Propagation and Transmission of Electromagnetic Waves
Staff Contact: Dr IM Skinner
CP15

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 TB Vu
CP15

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, optimisation 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 EH Fooks
CP15

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: A/Prof TB Vu
CP15

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 PL Chu
CP15
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, polarisation-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. Synchronisation. Optical communication in hostile environments.

ELEC9370
Digital Image Processing Systems
Staff Contact: School Office
CP15

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 PD Neilson
CP15

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 PD Neilson
CP15
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: A/Prof T Hesketh
CP15
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 NW Rees
CP15
Prerequisites: ELEC9401, ELEC9402

Possible modules include: identification, estimation, multivariable systems, robust control, optimisation, 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 PD Neilson
CP15
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, optimisation, 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.

ELEC9410
Robotics, and Control of Non-Linear Systems
Staff Contact: School Office
CP15

The subject discusses aspects of the modelling and control of electromechanical systems including mobile robots, satellite stability, overhead cranes, automated vehicles and general manipulators. The trajectory controlled problem is highly non-linear and cannot be adequately solved by linear methods. Sliding mode control, input-output-linearisation, adaptive control and neural networks will be considered. Extensive use will be made of MATLAB and SIMULINK.

ELEC9411
Introductory Physiology for Engineers
Staff Contact: Prof BG Celler
CP15 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 PD Neilson
CP15
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
Optimisation and Optimal Control
Staff Contact: Dr DJ Clements
CP15 SS
Prerequisites: 1 undergraduate Control subject plus MATH2501

Constrained and unconstrained optimisation. Linear quadratic and geometrical programming techniques, the simplex method, Kuhn-Tucker necessary conditions, gradient methods. Dynamic programming, the optimum principle. Design control systems by optimisation methods.

ELEC9416
Non-linear Systems and Simulation
Staff Contact: Prof NW Rees
CP15 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
CP15
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 SR Wenham
CP15

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 metallisation. 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 emphasised.

ELEC9503
Integrated Circuit Design
Staff Contact: A/Prof CY Kwok
CP15
Prerequisite: Assumed knowledge ELEC3016.

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. Yield, reliability, failure analyis and packaging. MEMS technology. Non-volatile memory, low voltage low power circuits.

ELEC9504
Solar Energy Conversion
Staff Contact: Dr R Ramer
CP15

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 SR Wenham
CP15

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 CB Honsberg
CP15
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 MA Green
CP15
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 SR Wenham
CP15
Assumed Knowledge: ELEC2033 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 CY Kwok
CP30

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 JC 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 (project management for land 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 a Master of Engineering Science (Land Administration), of the graduate diploma in Geomatic Engineering 5492, and of the Graduate Diploma in Land Administration 5493. 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. Students may undertake selected subjects in the Master of Engineering Science and Graduate Diploma by distance learning.

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 Science and Technology. 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.

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 and the Institution of Engineers Australia (IEAust.) for admission as corporate members.

Students wishing to become Registered Surveyors with the New South Wales Surveyorsí Board after graduation are advised to gain practical experience under a Registered Surveyor during their course. Details are obtainable from the Registrar, Surveyorsí Board, Department of Lands, Bridge Street, Sydney 2000.

Field Excursions

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

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 425011) but must also have achieved a level equivalent to the Computer Science cut-off (429019) for the year of admission.

The course is specifically designed for students wishing to enter a career in Geomatic Engineering 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 geomatic 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.

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 135 credit points in the BA course with no more than 60 credit points obtained at first level (i.e. subjects designed for students in their first year of study). Of these 60 first level credit point, no more than 30 may be from any one School or Department.

2. Students must complete a major sequence in one of the following areas:

Chinese, Education Studies, English, Environmental Studies, French, German Studies, Greek (Modern), History, Indonesian, Music, Philosophy, Policy Studies, Political Science, Russian Studies, Science and Technology Studies, Sociology, Spanish and Latin American Studies, Theatre, Film and Dance.

Students completing an Environmental Studies major sequence must also complete a minor sequence of 45 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 than 30 credit points may be obtained from subjects in the BA course 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, provided they have also completed 30 credit points in General Education.

Combined Bachelor of Engineering (Geomatic Engineering)/Master of Commerce course

This above course will provide professional qualifications in engineering and business/commerce. It is suited to high ability students who have interests in technology and wish to work with, and manage teams of professionals, projects and business. The strength of the program is that you can graduate with a technical degree and complete the Master of Commerce (MCom) degree on a full-time or part-time basis, combining management training with on-the-job experience.

In this combined degree, students complete years 1 to 3 of the Bachelor of Engineering in Geomatic Engineering (Course 3741) . In Year 4, students are not required to complete GMAT 7722 Project Management of the BE course, but must complete the following three M.Com subjects:

ACCT 5901	Accounting: A User Perspective
ECON 5103	Business Core Elective
and	1 Commerce Core Elective

Students continuing the MCom course must complete six non-core Commerce electives in Year 5 and two non-core Commerce electives in Year 6. Students should consult the Handbook of the Faculty of Commerce and Economics for details of the electives.

There is a testamur awarded for each degree. The BE degree will be awarded on the satisfactory completion of the first four years of the course.

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				
GMAT 1100	Principles of Surveying	5	0	15
GMAT 1300	Computing Applications in Geomatics	4	0	15
MATH 1131	Mathematics 1A	6	0	15
or				
MATH 1141	Higher Mathematics 1A			
PHYS 1998	Physics	6	0	15
GMAT 1150	Survey Methods & Computations	0		5
15				
GMAT 1200	Visualisation of Spatial Data	0	4	15
GMAT 1400	Land Studies in Geomatics	0	5	15
MATH 1231	Mathematics 1B	0	6	15
or				
MATH1241	Higher Mathematics 1B			
Total HPW Session 1		**21**		
Total HPW Session 2		**20**		
Total Credit Points		**120**		

		HPW S1	HPW S2	CP
Year 2				
MATH 2019	Engineering Mathematics 2CE	3	0	7.5
MATH2829	Statistics SU	3	0	7.5
PHYS 2969	Physics of Measurement	3	0	7.5
GMAT 2100	Electronic Surveying Instrumentation: Principles and Practice	5	0	15
GMAT 2700	Geometry of Coord. Ref. Systems	5	0	15
MATH 2019	Engineering Mathematics 2CE	0	3	7.5
GMAT 2110	Electronic & GPS Positioning Technologies	0	5	15
GMAT 2200	Geographic Inf. Systems & CAD	0	5	15
GMAT 2300	Analysis of Observations	0	3	7.5
GMAT 2350	Computing for Spatial Information Sciences	0	3	7.5
General Education		2	2	15
Total HPW Session 1		**21**		
Total HPW Session 2		**21**		
Total Credit Points		**120**		

		HPW S1	HPW S2	CP
Year 3				
CIVL0646	Introduction to Water Engineering	3	0	9
CIVL0656	Introduction to Municipal Engineering	0	3	9
GMAT5011	Engineering Surveying	3.5	0	10.5
GMAT5112	Data Analysis and Computing 2	2.5	0	7.5
GMAT5122	Computer Graphics 2	2.5	0	7.5
GMAT5222	GPS Surveying	2.5	0	7.5
GMAT5621	Cadastral Surveying 1	3	0	9
GMAT6052	Field Projects 2	0	4	12
GMAT6512	Principles of Image Geometry	0	3	9
GMAT6522	Remote Sensing	0	3	9
GMAT6532	Spatial Information Systems 1	0	3	9
GMAT6621	Cadastral Surveying 2	0	3	9
PLAN1093	Planning Studies	2	0	7.5
General Education subject/s		2	2	15
Total HPW Session 1		**21**		
Total HPW Session 2		**21**		
Total Credit Points		**130.5**		

		HPW S1	HPW S2	CP
Year 4				
GMAT7052	Field Projects 3	3	0	9
GMAT7512	Photogrammetry and Mapping	3	0	9
GMAT7532	Spatial Information Systems 2	2	0	7.5
GMAT7612	Land Management and Development Project 1*	2	0	7.5
GMAT7722	Project Management 1	3	0	9
GMAT7811	Land Subdivision and Development	3	0	9

		HPW S1	HPW S2	CP
GMAT8001	Thesis	2	6	24
GMAT8011	Project Surveying	0	3	9
GMAT8222	Physical and Space Geodesy	0	2.5	7.5
GMAT8311	Offshore Positioning	0	2.5	7.5
GMAT8612	Land Management and Development Project 2*	0	2	7.5
GMAT8711	Professional Practice	2	1	9
GMAT8722	Project Management 2	0	3	9

Total HPW Session 1 **20**
Total HPW Session 2 **20**
Total Credit Points **124.5**

**Includes General Education Social and Environmental Responsibility*

Combined Courses

3746
Bachelor of Engineering in Geomatic Engineering/Bachelor of Science in Computer Science

BE BSc in Computer Science

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

Year 1
COMP1011, COMP1021, GMAT1100, GMAT1150, GMAT1400, MATH 1131 or MATH1141, MATH1231 or MATH1241, PHYS1998

Year 2
GMAT2100, GMAT2700, GMAT2110, GMAT2200, GMAT2300, MATH2841, MATH2501, MATH2510, MATH2520, PHYS2969, General Education subject/s

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 elective subjects (4 or 5 hours per week each)

Postgraduate Study

Formal graduate courses lead to the award of the degrees of Master of Engineering Science 8651, 8652 and 8653, and of 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 Science and Technology. 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.

8651
Geomatic Engineering

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,
- image analysis in photogrammetry and remote sensing,
- land administration,
- land and geographic information systems,
- remote sensing

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 30 credit points. Examples of suitable external subjects are computing, statistics, oceanography, project management and a range of others.

8651
Geomatic Engineering

Master of Engineering Science
MEngSc

(External Mode Delivery)

Core Subjects (15 CP each)

GMAT9950	Modern Technology in Geomatic Engineering
GMAT9951	Land Information Services
GMAT9952	GPS Surveying
GMAT9953	Remote Sensing

Additional subjects presented either in external or face to face mode can be selected from those offered by the Schools of Civil Engineering, Geography and Information, Library and Archive Studies.

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	15
GEOG9241	Advanced Geographic Information Systems or	15
GEOG9280	Application and Management of GIS or	15
GMAT9604	Land Information Systems	15

Elective subjects		**CP**
COMP9311	Data Base Systems	15
ELEC9336	Digital Communication Networks 1	15
GEOG9150	Remote Sensing Applications	15
GEOG9290	Image Analysis in Remote Sensing	15
GMAT9107	Special Topic in Geomatic Engineering B	15
GMAT9532	Data Acquisition and Terrain Modelling	15
GMAT9600	Principles of Remote Sensing	15
GMAT9606	Microwave Remote Sensing	15
LIBS0815	Economics of Information Systems	10
LIBS0817	Information Storage and Retrieval Systems	15
Project		30

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 Science and Technology. 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 seven 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**
CIVL8731	Project Management Framework	12
GMAT9604	Land Information Systems	15
GMAT9608	Cadastral Systems	12
GMAT9609	Land Registration Systems	12
GMAT9610	Reform in Land Titling and Registration	12
GMAT9611	Land Law for Land Administration	12
SOCI5336	Sociology of Development	12

Elective subjects		CP
BLDG7101	Valuation 1 (Introduction)	12
CIVL8701	Financial Management	12
GEOG9240	Principles of Geographic Information Systems	15
GEOG9241	Advanced Geographic Information Systems	15
GEOG9280	Application and Management of Geographical Information Systems	15
GMAT7532	Spatial Information Systems 2	15
GMAT9533	Land Use Mapping and Administration	15
ACCT5917	Strategic Management: Systems and Processes	12
ILAS0301	Record Keeping Principles and Structures	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	15
GEOG9290	Image Analysis in Remote Sensing	15
GMAT9600	Principles of Remote Sensing	15
GMAT9606	Microwave Remote Sensing	15
Project in Remote Sensing (one elective project to be chosen from the list below)*		30

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	15
ELEC9408	Computer Display Systems and Interactive Instrumentation	15
GEOG9210	Computer Mapping and Data Display	15
GEOG9240	Principles of GIS	15
GEOG9241	Advanced Geographic Information Systems	15
GEOL0360	Remote Sensing Applications in Geoscience	15
GMAT9604	Land Information Systems	15
GEOG9280	Application and Management of GIS	15

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 75 credit points, made up of five 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
CIVL8731	Project Management Framework	15
GMAT9604	Land Information Systems	15
GMAT9608	Cadastral Systems	15
GMAT9609	Land Registration Systems	15
SOCI5336	Sociology of Development	15

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: School Office
CP9 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: Dr BR Harvey
CP 13.5 S2 L2 T2.5
Note/s: This is a servicing subject taught within courses offered by other schools and faculties

Principles of surveying; coordinate 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: Contact School Office
CP9 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 coordinate 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
CP9
Prerequisite: GMAT0442 or 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 Civil Engineers.

GMAT0580
Mining Surveying
Staff Contact: School Office
CP9 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 JC Trinder
CP12 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: Dr EG Masters
CP7.5 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 coordinate 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.

GMAT1100
Principles of Surveying
Staff Contact: A/Prof W Kearsley
CP15 S1 HPW5

Induction to Geomatic Engineering: a 2 day workshop will be held in week 3 of the course to discuss the range of topics covered in Geomatic Engineering, gain hands-on experience with the School's facilities and laboratories, and develop teamwork amongst the students.

Horizontal reference frames and positions. Tubular bubbles, surveying telescopes. Theodolites; direction measurement. Distance measurement with steel tapes, bands and electronic tacheometers. Total stations. GPS positioning. Detail surveys. Levelling, level runs, instrument errors and tests. Field techniques and data recording. Use of minor survey equipment. Reconnaissance surveys: field sketches and planning. Recovery sketches.

GMAT1150
Survey Methods and Computations
Staff Contact: Dr B Harvey
CP 15 S2 HPW 5
Prerequisite: GMAT 1100

Principles of calculations. Intersection, resection, trilateration, traverse measurements and calculations. Missing data problems. Traversing, types of traverses, errors in traverses, errors detection and adjustment. Road intersections. Area calculations. Subdivision calculations. 2D similarity transformations and PO adjustments. Spherical trigonometry, direction of Sun calculations, shadow diagrams. Contour surveys. Detail surveys, radiations, use of theodolite and EDM, field procedures, electronic tacheometers and electronic fieldbooks/data recorders, field sketches, principle and computation of free stationing.

GMAT1200
Visualisation of Spatial Data
Staff Contact: Dr B Harvey
CP15 S2 HPW 4

Principles of visual communication. Drafting, plotting, contouring, field sketches. Computer painting, drawing and CAD. Cartographic design. Map use. Charts and graphs. 2D-3D visualisation. Engineering drawing: orthographic and pictorial. Descriptive geometry. Web page design. Interpreting technical drawings, cadastral and engineering. Powerpoint presentations.

GMAT1300
Computing Applications in Geomatics
Staff Contact: Dr E G Masters
CP15 S1 HPW4

Applications of computing technology to Geomatics including the development of proficiency with commonly used software packages. Overview of hardware, operating systems, networks, the internet, applications software, and peripherals including storage media, printers, scanners, digitizers. Use of word processors, spreadsheets, databases, presentation packages, graphics and visualisation packages, publishing and multi-media, browsers and email. The application of these packages to various aspects of Geomatics including data input, data manipulation, data management and storage, data presentation and communication.

GMAT1400
Land Studies in Geomatics
Staff Contact: A/Prof C Rizos
CP15 S2 HPW5

What is "Land"? Topographic and geomorphological descriptions of land. Land cover classification: soils and vegetation. Landuse: rural and urban land. Land value and land economics. Land as a recreational resource, national parks, and ecological issues. Land as Real Estate. Land ownership and rights to use and redevelopment. Land from the cultural, social and spiritual perspectives. Native and other forms of "title". Land, water and air space rights. Law of the Sea and sovereign rights over marine resources. State, Local and Federal Government jurisdictions over land. Professional communications will be an integral component of the subject. Students will be expected to analyse the subject material and prepare appropriate responses, including: poster presentations, addresses to a mock local government council meeting, PowerPoint presentations, and application of research methodology for the WWW and subsequent preparation of reports.

2nd Year

GMAT2100
Electronic Surveying Instrumentation: Principles and Practice
Staff Contact: A/Prof JM Rüeger
CP15 S1 HPW5
Prerequisites: GMAT1100, GMAT1150

Precise digital levelling (bar code) instruments and techniques; design, accuracy, errors. Precise levelling techniques, design and location of bench marks. systematic and random errors, motorised levelling. Electronic theodolites, construction, circle reading, level sensors, centring systems, constrained centring, electronic data recording. Sources, testing and elimination of errors in electronic theodolites, eccentricities of alidade and horizontal circle. Vertical circle and level sensor errors; circle graduation errors. Centring and levelling of theodolites. Precise horizontal angle measurement, definition of an arc of directions, observation procedures, elimination of errors, National and State specifications; precise zenith angle measurement. Trigonometric heighting, effects of earth curvature and refraction, observation procedures, precision of computed heights; EDM-height traversing.

GMAT2110
Electronic and GPS Positioning Techniques
Staff Contact: A/Prof JM Rüeger
CP15 S2 HPW 5
Prerequisites: GMAT1100, GMAT1150
Co-requisites: GMAT2100

Principles and applications of EDM: basic working principles; phase measurement techniques, coefficient of refraction, flight-time measurement in short range pulse distance meters, working principles of microwave distance meters; wave propagation in atmosphere, atmospheric transmittance and range equation; measurement of atmospheric parameters, velocity corrections; geometric reductions, reductions of distances to the spheroid, analysis of errors, corrections to EDM measurements; elctro-optical distance meters; calibration of electro-optical instruments; reflectors; field procedures. GPS surveying; the GPS signal and measurement characteristics; GPS instruments; GPS planning, field and office procedures; GPS observations and equations; baseline measurements; networks; presentation of GPS measurements, datums, coordinate systems and heights; data acquisition from maps and images.

GMAT2200
Geographic Information Systems & CAD
Staff Contact: Ms L Li
CP 15 S2 HPW 5
Co-requisites: GMAT 2700, GMAT 2110

Inputting both spatial and attribute data to the GIS. Transformation of data between coordinate systems, such as digitizer coordinates, geodetic and geographic coordinates, and map projection coordinates. Editing data and creating topologically clean data Tagging spatial data with attributes, linking spatial data to attribute databases. Use of basic analysis functions: spatial selection, attribute selection, making reports of spatial and attribute data interfacing to the system using a high level language. Surveying CAD Familiarisation with at least one CAD package commonly used in engineering surveying. Data entry for detail survey. Editing and setting attributes within the package. Contouring. Plan drawing. Demonstration of alternative CAD packages.

GMAT 2300
Analysis of Observations
Staff Contact: Dr E Masters
CP 7.5 S2 HPW 3
Pre-requisites: MATH 1231, MATH 2019, GMAT 1150

Least squares principles and reasons for applying least squares solutions. Modelling observations, observation equations, parametric method, condition method. Linearisation of equations. Derivation of least squares; methods of forming normal equations. Worked examples in various areas of geomatics. The derivation of variance-covariance matrices. Analysis of variance-covariance matrix, application of statistics and error analysis in geomatics; error ellipses. Determining input into least squares using typical adjustment software. Introduction to advanced least squares.

GMAT2350
Computing for Spatial Information Sciences
Staff Contact: Ms L Li
CP 7.5 S2 HPW3
Co-requisite: GMAT1300

Principles of program design. Algorithm development and programming languages. Procedural programming and event driven programming. Constant and variables types, data elements, input, output, event, syntax, loops, condition statements, procedures, forms and controls, menus and multiple document interface. Applications and GUI; application development in common programming languages. Exercises in program development.

GMAT 2700
Geometry of Coordinate Reference Systems
Staff Contact: A/Prof W Kearsley
CP15 S1 HPW 5

Cartesian coordinate systems, applications of cartesian coordinate transformations in geomatics. Mathematical transformations between geodetic, cartesian and topocentric coordinate systems, ellipsoid geometry, orthometric and ellipsoid height systems; Keplerian orbit representation and the transformation of Keplerian elements into other satellite coordinate and velocity representations. Map projections and ellipsoidal geometry, principles of map projections, surveying and mapping projections, transverse Mercator projection, ellipsoidal computations. Corrections to field observations. Geodetic and astronomical reference systems; the relationship between natural and geodetic reference systems, deflection of the vertical;, geoid models and reference ellipsoids, height systems, celestial coordinate systems. Geodetic coordinate systems and datums; definition of AGD, GDA and AHD.

GMAT5011
Engineering Surveying
Staff Contact: School Office
CP10.5 S1 L3 T0.5
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 BR Harvey
CP7.5 S1 L2T5
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
CP9 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
CP7.5 S1 L2T0.5
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
CP9 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
CP12 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 JC Trinder
CP9 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 JC Trinder
CP9 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 EG Masters
CP9 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
CP9 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
CP9 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 JC Trinder
CP9 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
CP7.5 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
CP7.5 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 JC Trinder
CP9 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 JC Trinder
CP9 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
CP24 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 JM Rueger
CP9 S2 L2 T1
Corequisites: GMAT5011

Selected topics from: monitoring of deformations and settlement of terrain, structures and machines; design and optimisation 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 AHW Kearsley
CP75 S2 L2 T5
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
CP7.5 S2 L2 T0.5
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
CP7.5 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 BR Harvey
CP9 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 JC Trinder
CP9 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
CP15

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
CP15

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 BR Harvey
CP15 SS L2 T1

Selected topics from: Geodetic datum and invariant quantities, measures of accuracy, testing of hypotheses, out-lier detection, internal and external reliability and sensitivity criteria, variance component estimation, design and optimisation of deformation monitoring networks, two-epoch analysis, multi-epoch analysis, case studies of monitoring networks.

GMAT9211
Introduction to Geodesy
Staff Contact: A/Prof AHW Kearsley
CP15 S2 L2 T1

Geodesy in the service of mankind. The earthís gravity field. The earthís motion in space. Coordinate 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
CP15 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.

GMAT9532
Data Acquisition and Terrain Modelling
Staff Contact: Prof JC Trinder
CP15 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 BJC Trinder
CP15 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: School Office
CP15 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 EG Masters
CP15 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.

GMAT9606
Microwave Remote Sensing
Staff Contact: School Office
CP15 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 JC Trinder
CP15 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.íCrowní 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 JC Trinder
CP15 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 JC Trinder
CP15 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 JC Trinder
CP 15 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 EG Masters
CP 15 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
CP 15 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: School Office
CP 15 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
CP 30

GMAT9912
Project
CP 48

School of Mechanical and Manufacturing Engineering

(incorporating Aerospace Engineering and Naval Architecture)

Head of School
Professor BE Milton (31/12/98)

Executive Assistant to Head of School
A/Prof EM Kopalinsky (31/12/98)

Administrative Officer
Vacant

The School offers courses in Aerospace Engineering, Mechanical Engineering, Manufacturing Engineering and 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 Manufacturing Engineering **8531** and in Mechanical Engineering **8541**, and the Graduate Diploma in Manufacturing 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 an 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. Final year students enrolled in Manufacturing Engineering and Management (course 3663) and Mechanical Engineering (course 3680) may also take a Bachelor of Engineering/Master of Commerce Program, which will facilitate their entry into the MCom program on completion of their BE degree course.

For the five current BE courses, Year 1 comprises the study of the basic sciences – mathematics, physics and chemistry – together with an introduction to engineering. 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.

Years 1 and 2 of the courses of Mechanical Engineering, Manufacturing Engineering and Management, Aerospace Engineering, Mechatronic Engineering and Naval Architecture are identical, and students attend classes together. Years 3 and 4 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.

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, except that students enrolled in MECH4003 Thesis 1 may take MECH4001 Communications for Professional Engineers and MECH4002 The Engineer in Society in the year prior to the final year of their program, see following note.

Alternative Thesis Arrangements

Students with non-standard programs may opt to substitute MECH4003 Thesis 1 (0,6,**15**) and MECH4004 Thesis 2 (6,0,**15**) for MECH4000 Thesis (6,6,**30**). This option will allow the thesis project to be undertaken from mid-year to

mid-year, rather than from year-end to year-end, and may result in the fulfilling of all requirements for the award of the degree one session earlier than would otherwise be the case. The following should be noted in relation to this option:

- MECH4003 and MECH4004 must be done in two consecutive sessions which are the final two sessions of active candidature required to fulfil the requirements for the award of the degree;
- total notional session hours per week for which the student is enrolled must not exceed 24 in either of the two sessions involved;
- it is to be emphasised that the one single thesis project is to consume the full extent of both MECH4003 and MECH4004;
- the accrual of the credit points for either MECH4003 or MECH4004 is contingent upon a satisfactory completion of both of these subjects; withdrawal from either subject prior to satisfactory completion of MECH4004 necessitates the undertaking of a different thesis project and a loss of all credit points associated with the abandoned project, as would be the case if a project were abandoned in MECH4000;
- MECH4003 is graded *Satisfactory/Unsatisfactory*; MECH4004 carries the mark for the thesis project;
- all other rules relating to the thesis apply.

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 Engineering and 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
MANF1120	Introduction to Manufacturing	0	5	10
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	15
MATS9520	Engineering Materials	0	3	7.5
MECH1120	Design and Engineering Profession	3	0	7.5
MECH1130	Design Graphics	0	3	7.5
MECH1300	Engineering Mechanics 1	4	0	10
MECH1400	Mechanics of Solids 1	0	3	7.5
MECH1500	Computing 1M	3	0	7.5
PHYS1918	Physics 1ME	6	0	15
Total HPW Session 1		**22**		
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:

Year 1 of all Science Compatable courses				
CHEM1101	Chemistry 1A	6	0	15
MANF1120	Introduction to Manufacturing	0	5	10
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	15
MECH1120	Design and Engrg Profession	3	0	7.5
MECH1130	Design Graphics	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				
CHEM1002	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		**25**		
Total HPW Session 2		**29**		
Total Credit Points		**132.5**		

		HPW S1	HPW S2	CP
Year 2 of all courses				
ELEC0807	Electrical Engineering 1E	0	4	10
MATH2009	Engineering Mathematics 2	4	4	20
MATH2839	Statistics SM	3	0	7.5
MECH2000	Preparation for Industrial Training	0	0	0.5
MECH2100	Machine Design	3	3	15
MECH2320	Engineering Mechanics 2B	2	2	10
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		2	2	15
Total HPW Session 1	**21**			
Total HPW Session 2	**22**			
Total Credit Points	**113**			

For MATH2009 students may substitute MATH2501, MATH2011 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	0	4	10
AERO3602	Flight Dynamics 1	2	0	5
MANF3400	Engineering Economics	2	0	5
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3200	Engineering Experimentation	2	2	10
MECH3211	Linear Systems Analysis	3	0	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH2310	Vibration Analysis	3	0	5
MECH3400	Mechanics of Solids 3	4	0	10
MECH3520	Programming and Numerical Methods	3	0	7.5
or				
MECH3530	Computing Appications in Mechanical Systems	3	0	7.5
General Education subject/s		2	2	15
Total HPW Session 1	**22**			
Total HPW Session 2	**22**			
Total Credit Points	**112.5**			

		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	7.5
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 Engineering and Management

Bachelor of Engineering
BE

Years 3 and 4

The Manufacturing Engineering and 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 Engineering and 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 Engineering and 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 Engineering and 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
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
MECH3520	Programming and Numerical Methods	3	0	7.5
or				
MECH3530	Computing Appications in Mechanical Systems	3	0	7.5
General Education subject/s		0	4	15
Total HPW Session 1	**24.5**			
Total HPW Session 2	**20.5**			
Total Credit Points	**132.5**			

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, biomechanics, 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				
MANF3400	Engineering Economics	2	0	5
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3100	Machine Systems Design	3	3	15
MECH3200	Engineering Experimentation	2	2	10
MECH3211	Linear Systems Analysis	3	0	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH3300	Engineering Mechanics 3	0	2	5
MECH3330	Vibration Analysis	0	2	5
MECH3400	Mechanics of Solids 3	4	0	10
MECH3520	Programming and Numerical Methods	3	0	7.5
or				
MECH3530	Computing Applications in Mechanical Systems	3	0	7.5
MECH3600	Fluid Mechanics 2	2	0	5
MECH3701	Thermodynamics 2	0	2	5
MECH3702	Heat Transfer	0	2	5
General Education subject/s		2	2	15
Total HPW Session 1	**21**			
Total HPW Session 2	**20**			
Total Credit Points	**107.5**			

		HPW S1	HPW S2	CP
Year 4				
MANF4400	Engineering Management	2	0	6
MANF4412	Total Quality Management	0	2	6
MECH4000	Thesis	6	6	36
MECH4001	Communications for Professional Engineers	0	2	6
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.

Applied Mechanics				
MECH4301	Plane Mechanism Kinematics	3	or 3	7.5
MECH4310	Advanced Vibration Analysis	3	or 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	3	or 3	7.5
MECH4410	Engineering Applications of Finite Elements	3	or 3	7.5
MECH4440	Theory of Plasticity	3	or 3	7.5
Design				
MECH4120	Design Technology	3	or 3	7.5
MECH4131	Advanced CAD Modelling and Applications	3	or 3	7.5
MECH4150	Design and Maintenance of Components	3	or 3	7.5
Fluid and Thermal Engineering				
MECH4610	Advanced Fluid Dynamics	3	or 3	7.5
MECH4690	Special Fluid Mechanics Elective	3	or 3	7.5
MECH4700	Internal Combusion Engines	3	or 3	7.5
MECH4720	Solar Energy	3	or 3	7.5
MECH4730	Multiphase Flow	3	or 3	7.5

		HPW S1	HPW S2	CP
MECH4740	Thermal Power Plants	3 or 3		7.5
MECH4751	Refrigeration and Air Conditioning	3 or 3		7.5
MECH4790	Special Thermodynamics Elective	3 or 3		7.5

Mechatronic Engineering
See Mechatronic Engineering Technical Electives

Possible External Technical Elective

MATS9530	Materials Science for Mechanical Engineers	3 or 3		7.5

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.

Year 3

MANF3400	Engineering Economics	2	0	5
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3100	Machine Systems Design	3	3	15
MECH3200	Engineering Experimentation	2	2	10
MECH3202	Microprocessor Control	0	3	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	0	2	5
MECH3310	Vibration Analysis	0	2	5
MECH3400	Mechanics of Solids 3	4	0	10
MECH3530	Computing Applications in Mechanical Systems	3	0	7.5
MECH3600	Fluid Mechanics 2	2	0	5
MECH3701	Thermodynamics 2	0	2	5
or				
MECH3702	Heat Transfer	0	2	5
General Education subject/s		2	2	15

Total HPW Session 1 **22**
Total HPW Session 2 **21**
Total Credit Points **110**

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.

Mechatronic Engineering

MANF3500	Computers in Manufacturing 1	0	4	10
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	3 or 3		7.5

Computer Science and Engineering
Electrical Engineering
Choose at least one from the following list

COMP3111	Software Engineering	5 or 5		15
COMP3331	Computer Networks and Applications	0	5	15
ELEC3041	Real Time Engineering	4	0	10

Applied Mechanics
Design
Fluid and Thermal Engineering
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.

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	2	2	10
MECH3211	Linear Systems Analysis	3	0	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH3330	Vibration Analysis	0	2	5
MECH3400	Mechanics of Solids 3	4	0	10
MECH3520	Programming and Numerical Methods	3	0	7.5
or				
MECH3530	Computing 2	3	0	7.5
General Education subject/s		0	4	15

Total HPW Session 1 **20.5**
Total HPW Session 2 **21.5**
Total Credit Points **110**

		HPW S1	HPW S2	CP
Year 4				
MANF3400	Engineering Economics	2	0	5
NAVL4100	Principles of Ship Design 2	3	3	15
NAVL4110	Ship Design Project	3.5	3.5	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

Total HPW Session 1 **20.5**
Total HPW Session 2 **22.5**
Total Credit Points **129**

Combined Courses

Bachelor of Engineering/Bachelor of Science

3611
BE BSc in Aerospace Engineering

3664
BE BSc in Manufacturing Engineering and 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 UAI 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
MECH2320	Engineering Mechanics 2	2	2	10
MECH2411	Mechanics of Solids 1A	3	0	7.5
MECH2412	Mechanics of Solids 2B	0	3	7.5
MATH2011	Several Variable Calculus	4	0	15
MATH2120	Mathematical Methods for Differential Equations	0	2.5	7.5
MATH2501	Linear Algebra	2.5	2.5	15
MATH2520	Complex Analysis	0	2.5	7.5
	4.5 Level II units[1]	9+	9+	60+
Total HPW Session 1		**20.5+**		
Total HPW Session 2		**21.5+**		
Total Credit Points		**130+**		

		HPW S1	HPW S2	CP
Year 3				
MECH1500	Computing 1M	0	3	7.5
MECH2000	Preparation for Industrial Training	0	0	0.5
MECH2100	Machine Design	3	3	15
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	**22+**			
Total Credit Points	**128+**			

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 subjects 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
ELEC0807, MATH2011 (*or* MATH2110 *and* MATH2610), MATH2120 (*or* MATH2130),
MATH2501 (*or* MATH2601), MATH2520 (*or* MATH2620)
MATS9520, MECH2320, MECH2411, MECH2412
Total Credit Points 132.5

Year 3
MATH2841 (*or* MATH2839)
MECH1500[2], MECH2000, MECH2100, MECH2600, MECH2700
60 credit points of 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 133

Materials Science Majors

Year 2
CHEM2011, CHEM2021
MATH2011 (*or* MATH2110 *and* MATH2610), MATH2120 (*or* MATH2130), MATH2501 (*or* MATH2601), MATH2520 (*or* MATH2620)
MATS1002, MATS1142, MATS1072, MATS1112, MATS2213
MECH2320, MECH2411, MECH2412
Total Credit Points 140

Year 3
ELEC0807
MATH2841 (*or* MATH2839)
MATS1183, MATS1283, MATS2223, MATS3443, MATS4513, MATS4523, MATS4543
MECH1500[2], MECH2000, MECH2100, MECH2600, MECH2700
General Education subject/s
Total Credit Points 143

Mathematics Majors

Year 2
Same Year 2 as for Computer Science[3] *or* Materials Science[3] *or* Physics *or* Statistics[4] majors
or
ELEC0807
MATH2011 (*or* MATH2110 *and* MATH2610), MATH2120 (*or* MATH2130),
MATH2501 (*or* MATH2601), MATH2520 (*or* MATH2620)
MATS9520
MECH2320, MECH2411, MECH2412
525 credit points of appropriate Level II subjects from undergraduate offerings in the Science Handbook including some from the School of Mathematic[5]
Total Credit Points 140

Year 3
MATH2841 (*or* MATH2839)
MECH1500[2], MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
60 credit points of Level III subjects from School of Mathematics undergraduate offerings in the Science Handbook
General Education subject/s
Total Credit Points 133

Physics Majors

Year 2
MATH2011 (*or* MATH2110 *and* MATH2610), MATH2120 (*or* MATH2130),
MATH2501 (*or* MATH2601), MATH2520 (*or* MATH2620)
MATS9520
MECH2320, MECH2411, MECH2412
PHYS2001, PHYS2011, PHYS2021, PHYS2031
Total Credit Points 137.5

Year 3
MATH2841 (*or* MATH2839)
MECH1500[2],
MECH2000, MECH2100, MECH2310, MECH2600, MECH2700
PHYS3010 *or* PHYS3210, PHYS3021, PHYS3030, (*or* PHYS3230), PHYS3041
15 credit points of Level III subjects from School of Physics undergraduate offerings in the Science Handbook
General Education subject/s
Total Credit Points 140.5

Statistics Majors

Year 2
ELEC0807
MATH2011 (*or* MATH2110 *and* MATH2610), MATH2120 (*or* MATH2130), MATH2501 (*or* MATH2601), MATH2520 (*or* MATH2620), MATH2801 (*or* MATH2901), MATH2831 (*or* MATH2931), MATH2810 (*or* MATH2910), MATH2840 (*or* MATH2940)
MATS9520
MECH2320, MECH2411, MECH2412
75 credit points of appropriate Level II Science subject
Total Credit Points 140

Year 3
MECH1500[2], MECH2000, MECH2100, MECH2600, MECH2700
60 credit points of Level III subject from Statistics undergraduate offerings in the Science Handbook
15 credit points of 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 133

Notes

1. The following considerations pertain to the choice of additional subjects 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 and Telecommunications, 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 7.5 credit point Level II subject.

Combined Courses

Bachelor of Engineering/Bachelor of Arts

3612
BE BA in Aerospace Engineering

3665
BE BA in Manufacturing Engineering and 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: at least 135 credit points including a major sequence.

Other Faculties: Major sequence plus at least 30 credit points from Schools within 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. Students who complete the BE program first may proceed to graduation with the degree of Bachelor of Engineering in the usual way provided they have also completed 30 credit points in General Education.

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.

Bachelor of Engineering/Master of Commerce Programs

These programs of study will facilitate the entry of students into the MCom program on completion of the BE degree courses in Manufacturing Engineering and Management and Mechanical Engineering.

There will be a testamur for each degree. The degree of Bachelor of Engineering will be awarded on the satisfactory completion of the first four years of the course. For assessment of Honours, the Commerce subjects in Year 4 will be included in the assessment averaged to replace the deleted engineering subjects.

Subjects in Years 1 to 4 are non-fee paying. Fees will be charged for subjects in Years 5 and 6.

Admission Requirements

Students must satisfy requirements for the BE in Engineering. Admission to the MCom program will require a credit grade average by the end of Year 3.

3663
BE MCom Program in Manufacturing Engineering and Management

Years 1, 2 and 3
Students complete the normal Years 1 to 3 of the Bachelor of Engineering in the Manufacturing Engineering and Management course 3663.

		HPW S1	HPW S2	CP
Year 3				
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
and				
ACCT5901	Accounting: A User Perspective	0	3	15
ECON5103	Business Economics	3	0	15
Commerce Core Elective		0	3	15
Total HPW Session 1	**23**			
Total HPW Session 2	**23**			
Total Credit Points	**137.5**			

Year 5
Six non-core Commerce Electives 90

Year 6
Two non-core Commerce Electives 30

3680
BE MCom Program in Mechanical Engineering

Years 1,2 and 3
Students complete the normal Years 1 to 3 of the Bachelor of Engineering in the Mechanical Engineering course 3680.

		HPW S1	HPW S2	CP
Year 4				
MANF4400	Engineering Management	2	0	5
MANF4412	Total Quality Mangement	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		9	6	37.5
and				
ACCT5901	Accounting: A User Perspective	0	3	15
ECON5103	Business Economics	3	0	15
Commerce Core Elective		0	3	15
Total HPW Session 1	**20**			
Total HPW Session 2	**24**			
Total Credit Points	**132.5**			

Year 5
Six non-core Commerce Electives 90

Year 6
Two non-core Commerce Electives 30

Postgraduate Study

Formal graduate courses offered are: the Master of Engineering Science in Manufacturing Engineering 8531 and in Mechanical Engineering 8541, and the Graduate Diploma in Manufacturing 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. For more information about these degrees please contact Ms Penny Morris, Telephone [02] 93854152, Email: p.morris@unsw.edu.au or A/Prof Masud Behnia, Telephone [02] 93854253, Email: m.behnia@unsw.edu.au.

Master of Engineering Science

8531
Manufacturing Engineering (MEngSc)

To satisfy the requirements for the degree students are required to complete 120 credit points.

A Program of Specialisation must be selected from the following list. Usually the maximum number of core subjects listed should be completed by the student.

The remaining subjects should be selected from the *Elective subjects* list. At the discretion of the Head of School a 30 credit point project, MANF9010, may be undertaken instead of two subjects. The 0 credit point Seminar, MANF9040, is compulsory for students undertaking the project.

Programs of Specialisation

1. Computer Integrated Manufacturing
Staff Contact: A/Prof K Hoang

Core subjects:		**CP**
MANF9340	Factory Automation	15
MANF9410	Total Quality Management	15
MANF9470	Production Management 1	15
MANF9560	Computer Integrated Manufacturing	15
MANF9543	CAD/CAM	15
MANF9544	Concurrent Product and Process Design	15
Elective subjects:		
MANF9601	Economic Decisions in Industrial Management	15
MANF9400	Industrial Management	15
MECH9410	Finite Element Applications	15

2. Industrial Management
Staff Contact: Dr B Kayis

Core subjects:		
MANF9400	Industrial Management	15
MANF9410	Total Quality Management	15
MANF9420	Managing Manufacturing Operations	15
MANF9470	Production Management 1	15
MANF9471	Manufacturing Strategy	15
MANF9601	Economic Decisions in Industrial Management	15
Elective subjects:		
MANF9543	CAD/CAM	15
MANF9544	Concurrent Product and Process Design	15
SESC9411	Principles of Ergonomics	15

3. Manufacturing Management (External A)
Staff Contact: Prof H Kaebernick

Note/s: 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. 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 8 subjects with a total of 120 credit points. For this program all core subjects are compulsory.

Subject descriptions for GSOE subjects are listed in this handbook under the Graduate School of Engineering.

Core subjects:		**CP**
GBAT9102	Management of Manufacturing Systems	30
MANF8544	Concurrent Product and Process Design	15
MANF8560	Computer Integrated Manufacturing	15
MANF8471	Manufacturing Strategy	15
MANF8340	Factory Automation	15
Elective subjects:		
GBAT9101	Project Management	15
GBAT9104	Management of Innovation and Technological Change	15
GBAT9105	Risk Management	15
GBAT9107	Maintenance Management	15
GBAT9111	Organisation for Total Quality Management	15

or any other subject from the MBT program as approved by the Head of School.

4. Manufacturing Management (External B)
Staff Contact: Prof H Kaebernick

Note/s: This program is available in Flexible Delivery Mode within 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 8 subjects with a total of 120 credit points. For this program all core subjects are compulsory.

Subject descriptions for GSOE subjects are listed in this handbook under the Graduate School of Engineering.

Core Subjects		**CP**
MANF8340	Factory Automation	15
MANF8471	Manufacturing Strategy	15
MANF8420	Managing Manufacturing Operations	15
MANF8455	Concurrent Product and Process Design	15
MANF8560	Computer Integrated Manufacturing	15
MANF8472	Production Planning and Control	15

Elective Subjects:		
GBAT9111	Organization for Total Quality Management	15
GBAT9107	Maintenance Management	15
GBAT9101	Project Management	15
GBAT9105	Risk Management	15
GBAT9104	Management of Innovation and Technological Change	15
GBAT9106	Information Systems Management	15

or any other subject from the MBT program as approved by the Head of School.

8541
Mechanical Engineering (MEngSc)

Two options are available to students: a general program or a specialised program.

I. The general MEngSc degree is designed for graduates wishing to enhance their career prospects or wanting to diversify into a specialised field of engineering, or to update their knowledge with advances in technology.

- A combination of mechanical and management subjects, which may be modelled to suit students' personal requirements, will add to their engineering knowledge and put them in line for a management position.
- To satisfy the requirements for the degree, students are required to complete 120 credit points. Each subject is worth 15 credit points and a project is worth 30 credit points.
- Subjects can be selected from the current Mechanical and Manufacturing Engineering timetables.
- At the discretion of the Head of School, a project, MECH9010, may replace two subjects.

II. Specialisation within the MEngSc degree may be undertaken by taking selective subjects in such areas as Aerospace Engineering, Computational Engineering, Mechanical Design, Mechatronic Engineering, Noise and Vibration and Refrigeration and Air Conditioning.

- To satisfy the requirements for the degree with a specialisation, students are required to complete 120 credit points. Each subject is worth 15 credit points and a project, MECH9010 or AERO9010, is worth 30 credit points.
- When specialising, usually the maximum number of core subjects listed should be completed by the student.
- The remaining subjects, in the first instance, should be selected from the *Elective subjects* list followed by any other subjects from the current Mechanical and Manufacturing Engineering timetables. At the discretion of the Head of School, a project may replace two subjects.

Programs of Specialisation

1. Aerospace Engineering
Staff Contact: Dr NEA Ahmed

Core subjects:		**CP**
AERO9105	Aerospace Vehicle Design and Manufacture	15
AERO9606	Aerodynamics	15

Elective subjects:		
AERO9415	Finite Element Analysis and Applications for Aerospace Structures	15
AERO9543	CAD/CAM for Aerospace Structures	15
AERO9607	Flight Dynamics	15
AERO9705	Aerospace Propulsion	15

2. Computational Engineering (Computational Fluid Dynamics and Heat Transfer Strand)
Staff Contact: A/Prof E Leonardi

Note/s: 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	15
ANCE8002	Supercomputing Techniques	15

Elective subjects:		
ANCE8101	Graphical Interfaces and Scientific Visualisation Techniques	15
ANCE8102	Mesh Generation	15
ANCE8105	Computational Fluid Dynamics or Computational Techniques for Fluid Dynamics	15
MECH9610	Advanced Fluid Dynamics	15
MECH9620	Computational Fluid Dynamics	15
MECH9750	Industrial Applications of Heat Transfer	15

3. Computational Engineering (The Structural Analysis Strand)
Staff Contact: A/Prof DW Kelly

Note/s: 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	15
ANCE8002	Supercomputing Techniques	15
Elective subjects:		
AERO9415	Finite Element Analysis and Applications for Aerospace Structures	15
AERO9543	CAD/CAM for Aerospace Structures	15
ANCE8101	Graphical Interfaces and Scientific Visualisation Techniques	15
ANCE8102	Mesh Generation	15
MECH9131	Advanced CAD Modelling and Applications	15
MECH9310	Advanced Vibration Analysis	15
MECH9400	Mechanics of Fracture and Fatigue	15
MECH9410	Finite Element Applications	15

4. Mechanical Design
Staff Contact: Mr AJ Barratt

Core Subjects		
MECH9120	Design Technology	15
MECH9131	Advanced CAD Modelling and Applications	15
MECH9150	Design and Maintenance of Components	15

5. Mechatronic Engineering
Staff Contact: Dr RA Willgoss

Core Subjects:		
MECH9201	Digital Logic Fundamentals for Mechanical Engineers	15
MECH9202	Microprocessor Fundamentals for Mechanical Engineers	15
MECH9211	Modelling and Control of Mechatronic Systems	15
MECH9221	Industrial Robotics	15
Elective Subject:		
MECH9222	Artificially Intelligent Machines	15

6. Noise and Vibration
Staff Contact: Dr JM Challen

Core subjects:		
MECH9310	Advanced Vibration Analysis	15
MECH9311	Fundamentals of Vibration	15
MECH9312	Fundamentals of Noise and Vibration Measurement	15
MECH9325	Fundamentals of Noise	15
MECH9326	Advanced Noise	15

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

Core subjects:		CP
MECH9751	Refrigeration and Air Conditioning 1	15
MECH9752	Refrigeration and Air Conditioning 2	15
MECH9753	Refrigeration and Air Conditioning Design 1	15
MECH9754	Refrigeration and Air Conditioning Design 2	15
Elective subjects:		**CP**
MECH9325	Fundamentals of Noise	15
MECH9326	Advanced Noise	15
MECH9610	Advanced Fluid Dynamics	15
MECH9720	Solar Thermal Energy Design	15
MECH9730	Multiphase Flow	15
MECH9740	Power Plant Engineering	15
MECH9742	Power Production Assessment	15
MECH9750	Industrial Applications of Heat Transfer	15
MECH9757	Ambient Energy Air Conditioning	15
MECH9761	Internal Combustion Engines 1	15

5455
Manufacturing Engineering

5456
Mechanical Engineering

Graduate Diploma

GradDip

The Graduate Diplomas are based on 90 credit points of coursework only. Subjects can be selected from the current Mechanical and Manufacturing Engineering timetables.

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 JR Page
CP15 F HPW3

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 DW Kelly
CP10 S2 HPW4
Prerequisites: 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 NEA Ahmed
CP10 S1 HPW4
Prerequisites: MECH2600

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 JR Page
CP5 S1 HPW2
Prerequisites: MECH2300, MECH2310

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 JR Page
CP15 F HPW3
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 Z Vulovic
CP5 S1 HPW2
Prerequisites: AERO3601, AERO3602, MECH3212
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 JR Page
CP5 S2 HPW2

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 DW Kelly
CP15 F HPW3
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 NEA Ahmed
CP10 F HPW2
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 JR Page
CP7.5 S1 HPW3
Prerequisites: AERO3602

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 RT Casey
CP10 F HPW2
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 JR Page, Dr NEA Ahmed
CP30
Note/s: The project must be completed in no more than two sessions

AERO9105
Aerospace Vehicle Design and Manufacture
Staff Contact: Mr JRPage, Dr NEA Ahmed
CP15 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 DW Kelly
CP15 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 JR Page, A/Prof K Hoang
CP15 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 NEA Ahmed
CP15 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 JR Page
CP15 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
CP15 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: A/Prof RM Kerr
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: A/Prof P Mathew
CP7.5 S1 HPW3
Note/s: Protective items (eg safety glasses, safety boots, etc) are 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.

MANF1120
Introduction to Manufacturing
Staff Contact: A/Prof P Mathew
CP10 S2 HPW5
Note/s: Protective items (eg safety glasses, safety boots, overalls or dustcoat, etc) are required for the practical training in order to comply with the Occupational and Safety Act. Students must possess these items before commencing this course. The cost of the items is approximately $100. Students, who have done appropriate Technology based subjects at school or have an appropriate trade or certificate qualification or are suitably employed, may seek an exemption from the practical training classes
Excluded: MANF1100

The relationship between product design and manufacturing processes is introduced with theoretical and practical classes. Description and elementary analysis of manufacturing processes such as forming from liquid or solid, material removal and material joining. Practical training of approximately 33 hours will involve processes such as welding, fitting and machining as well as introduction to safety in a manufacturing environment.

MANF3200
Product Design and Manufacturing Technology
Staff Contact: Dr KC Chan
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. The analysis 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 LE 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: Dr M Chowdhury
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: A/Prof P Mathew
CP10 S1 HPW4
Prerequisites: MANF1120 *or* 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, MANF1120 *or* 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 RM Kerr
CP15 S1 HPW4 S2 HPW2
Prerequisites: MATH2839, MECH1500
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.

MANF4010
Manufacturing Systems Design
Staff Contact: Dr KC Chan
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 optimisation, workplace design, factory layout, production control system, detailed budget.

MANF4300
Design of Manufacturing Facilities 2
Staff Contact: Dr KC Chan
CP10 S2 HPW4
Corequisite: MANF3300

Introduction to plant layout design and materials handling system. Analysis and simulation of 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: A/Prof P Matthew
CP6 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: Dr B Kayis
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: Dr B Kayis
CP5 S2 HPW2
Note/s: Excluded MANF4411

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: A/Prof RM Kerr
CP20 S1 HPW6 S2 HPW2
Prerequisites: MANF3400, MANF3410, MANF3600
Note/s: Excluded MANF0420

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 RM Kerr
CP10 S1 HPW4
Prerequisite: MANF3600

More advanced linear programming; general mathematical optimisation 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.

MANF8340
Factory Automation
Staff Contact: A/Prof P Mathew, Prof H Kaebernick
CP15 SS HPW3
Note/s: Excluded MANF9340

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.

MANF8420
Managing Manufacturing Operations
Staff Contact: Dr B Kayis
CP15 SS HPW3

Managing manufacturing operations as a competitive weapon, strategic linkage of operations through quality, value added management, strategic quality management approach, International Human Resource Management, Technology Transfer, Strategic Management of Technology, Variation and its Causes, improvement strategies, productivity and its measurement, Taguchi techniques.

MANF8471
Manufacturing Strategy
Staff Contact: A/Prof RM Kerr
CP15 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.

MANF8472
Production Planning and Control
Staff Contact: A/Prof RM Kerr
CP15 SS HPW3
Note/s: Excluded GSOE9102

Industry dynamics; Porters Model; bases for competition and implications for Production Planning and Control. Dynamics of materials flow; role of inventory; effect of bottlenecks and process variability on materials flow. Planning levels and timescales; forecasting; aggregate planning; the Master Production Schedule. Manufacturing Resources planning and its limitations. Optimised Production Technology and synchronised manufacturing; Just in Time production; Kan Ban systems; mixed model production; evolution towards JIT. Maintenance management; preventive and predictive maintenance; Total Productive Maintenance. Role of Information Technology in Production Planning and Control; decision support and expert systems as applied to planning and scheduling.

MANF8544
Concurrent Product and Process Design
Staff Contact: Prof H Kaebernick, Dr LE Farmer
CP15 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 Manufacturing
Staff Contact: A/Prof K Hoang
CP15 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.

MANF9000
Research Thesis Mechanical and Manufacturing Engineering (Full time)
Staff Contact: A/Prof M Behnia

MANF9001
Research Thesis Mechanical and Manufacturing Engineering (Part time)
Staff Contact: A/Prof M Behnia

MANF9010
Project
Staff Contact: Prof H Kaebernick
CP30
Note/s: The project must be completed in no more than two sessions

MANF9040
Seminar (Manufacturing)
Staff Contact: Prof H Kaebernick
CP0

MANF9340
Factory Automation
Staff Contact: Dr P Mathew
CP15 SS HPW3
Note/s: Excluded MANF8340

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 intelligent manufacturing. Communication networks in a factory environment. Strategies for factory automation.

MANF9400
Industrial Management
Staff Contact: Prof H Kaebernick
CP15 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
CP15 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.

MANF9420
Managing Manufacturing Operations
Staff Contact: Dr B Kayis
CP15 SS HPW3
Note/s: Excluded MANF8420

Managing manufacturing operations as a competitive weapon, strategic linkage of operations through quality, value added management, strategic quality management approach, International Human Resource Management, Technology Transfer, Strategic Management of Technology, Variation and its Causes, improvement strategies, productivity and its measurement, Taguchi techniques.

MANF9470
Production Management 1
Staff Contact: A/Prof RM Kerr
CP15 SS HPW3

Dynamics of industry competitiveness: Porterìs 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.

MANF9471
Manufacturing Strategy
Staff Contact: A/Prof RM Kerr
CP15 SS HPW3
Note/s: Excluded MANF8471

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.

MANF9472
Production Planning and Control
Staff Contact: A/Professor RM Kerr
CP15 SS HPW3
Note/s: Excluded MANF8472

Industry dynamics; Porters Model; bases for competition and implications for Production Planning and Control. Dynamics of materials flow; role of inventory; effect of bottlenecks and process variability on materials flow. Planning levels and timescales; forecasting; aggregate planning; the Master Production Schedule. Manufacturing Resources planning and its limitations. Optimized Production Technology and synchronized manufacturing; Just in Time production; Kan Ban systems; mixed model production; evolution towards JIT. Maintenance management; preventive and predictive maintenance; Total Productive Maintenance. Role of Information Technology in Production Planning and Control; decision support and expert systems as applied to planning and scheduling.

MANF9491
Special Topic in Manufacturing Engineering
Staff Contact: Prof H Kaebernick
CP15

MANF9492
Special Topic in Manufacturing Engineering
Staff Contact: Prof H Kaebernick
CP15

MANF9543
Computer Aided Design/Computer Aided Manufacture
Staff Contact: A/Prof K Hoang
CP15 SS HPW3
Note/s: Student numbers are limited due to computer availability Preference will be given to CIM Program students Students must contact the Lecturer 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
CP15 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: A/Prof K Hoang
CP15 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
CP15 SS HPW3

Concept of economic analyses. Cost concepts; interest and interest formulae. Methods for economy studies; present worth, 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 RA Platfoot
CP7.5 S1 L1 T2
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 CV Madhusudana
CP10 S2 L2 T2
Prerequisites: As for MECH1300 Engineering Mechanics 1
Note/s: Excluded 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 coordinates. Simple rotation. Equations of motion. Work, energy and power. Impulse and momentum.

MECH0440
Engineering Statics
Staff Contact: Dr CV Madhusudana
CP7.5 S2 L2 T1
Prerequisites: As for MECH1300 Engineering Mechanics 1
Note/s: Excluded MECH0330, 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.

MECH1120
Design and the Engineering Profession
Staff Contact: Dr RA Platfoot
CP7.5 S1 HPW3

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. Introduction to engineering hardware and components; geometry, function, manufacture and reasons for various configurations. The design process, problem identification, search for solution concepts, nontechnical considerations in design, decision techniques, detail design and analysis.

MECH1130
Design Graphics
Staff Contact: Mr AJ Barratt
CP7.5 S2 HPW3
Corequisite: MANF1120

Free-hand sketching and drawing techniques, orthogonal projection sections and conventional symbols to communicate information about components. Computer graphics modelling of components and production of detail drawings. Elementary functional analysis of product design for manufacturing and performance.

MECH1300
Engineering Mechanics 1
Staff Contact: A/Prof RAJ Ford
CP10 S1 or S2 L2 T2
Prerequisite: As a suitable preparation for this course, it is strongly recommended that students have taken either 2 unit HSC Science (Physics) or 3 unit HSC Science multistrand or 2 unit HSC Industrial Arts (Engineering Science) or equivalent
Corequisites: MATH1131 *or* MATH1141
Note/s: Excluded MECH0330

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 1M
Staff Contact: Dr MJ Tordon
CP7.5 S1 L2 T1

Introduction: history, applications, hardware, software, a model of a computer system, editors, operating systems. Networking and the internet. Program design and development: programming objectives, data structures, algorithms, symbolic names, translation of algorithms, steps in programming, programming style, errors and debugging. Data: data types, declarations, input output,

file control. Programming constructs: arithmetic expressions, assignments, relational and logical expressions, selection. Application in sorting, word processing, graphics and plotting, simultaneous linear algebraic equations.

MECH2000
Preparation for Industrial Training
Staff Contact: A/Prof K Hoang
CP0.5 S2 4 hours total
Prerequisite: MECH1120 *or* 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
Machine Design
Staff Contact: A/Prof RB Frost
CP15 F HPW3
Prerequisites: MANF1120 *or* MANF1110, MECH1130 *or* MECH1100, MECH1400
Corequisite: MECH1120

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.

MECH2320
Engineering Mechanics 2
Staff Contact: Prof KP Byrne
CP10 F L1 Tl
Prerequisites: MATH1231 *or* MATH1241, MECH1300
Note/s: Excluded MECH0430, MECH2300

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.

MECH2411
Mechanics of Solids 2A
Staff Contact: Dr HL Stark
CP7.5 S1 or S2 HPW3
Prerequisites: MATH1231 or MATH1241
Corequisite: MECH1400
Note/s: Excluded MECH2401

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. Material properties and testing.

MECH2412
Mechanics of Solids 2B
Staff Contact: Dr HL Stark
CP7.5 S2 HPW3
Prerequisite: MECH2411
Note/s: Excluded MECH2402

Simple bending and unsymmetrical bending of beams. Second moments of area. Bending of composite beams, reinforced concrete beams. Transverse shear stresses in beams. Shear centre. Combined stresses in beams. Column buckling. Membrane stresses.

MECH2600
Fluid Mechanics 1
Staff Contact: Prof GL Morrison
CP10 F L1 T1
Prerequisites: MATH1131 or MATH1141, PHYS1918

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: MATH1131 or MATH1141, PHYS1918

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
Machine Systems Design
Staff Contact: Mr AJ 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 MJ Tordon
CP10 F HPW2
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

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 RA 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 RA Willgoss
CP7.5 S2 L2 T1
Prerequisite: MECH3211

Introduction to modern systems analysis. Review of modelling, simulation and non-linear systems. Stability criteria; use of Root Locus and Bode for system analysis and modification. The matrix exponential and state space notation. The transfer matrix. Pole and state feedback, controllability and observability. Use of MATLAB as a simulation environment.

MECH3300
Engineering Mechanics 3
Staff Contact: A/Prof JE Baker
CP15 S1 HPW2
Prerequisites: MATH2009, MECH2320 *or* MECH2300

Satellite motion. Gyroscopic torque. Geometry of gear tooth profiles; standard and non-standard gear proportions. Gear trains; epicyclic gears. Static and dynamic balancing of rotating and reciprocating mass systems. 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.

MECH3330
Vibration Analysis
Staff contact: A/Prof RAJ Ford
CP7.5 S1 HPW3
Prerequisites: MATH2009, MECH2320 *or* MECH2300
Note/s: Excluded: MECH2310, MECH3310, MECH9311

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.

MECH3400
Mechanics of Solids 3
Staff Contact: Prof EJ Hahn
CP10 S1 HPW4
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.

MECH3520
Programming and Numercial Methods
Staff Contact: Dr I Maclaine-Cross
CP7.5 S1 HPW3
Prerequisites: MATH2009, MECH1500
Note/s: Excluded MANF3800, MECH3800

Programming language features essential to complex engineering calculations. Logic, control, arrays, functions and subroutines in FORTRAN. Application of numerical methods to solve non-linear equations, linear and non-linear systems, differencing schemes, ordinary and partial differential equations in mechanical engineering applications.

MECH3530
Computing Applications in Mechanical Systems
Staff Contact: Dr J Katupitiya
CP7.5 S1 HPW3
Prerequisite: MECH1500
Note/s: Excluded MECH3510

Development of programming skills in the C++ language for applications 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. Interrupt service routines and introduction to real -time programming. Development of C++ routines for integration with MATLAB for data acquisition.

MECH3600
Fluid Mechanics 2
Staff Contact: Dr IL Maclaine-cross
CP5 S1 HPW2
Prerequisites: MATH1231 *or* MATH1241, MECH2600, MECH2700

Dimensional analysis, dynamic similarity, turbomachines; boundary, layer flow; compressible flow.

MECH3701
Thermodynamics 2
Staff Contact: A/Prof E Leonardi
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 GL Morrison
CP5 S2 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 transfer. Experiments and heat transfer measurements.

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: A/Prof JE Baker
CP5 S2 HPW2
Prerequisites: MECH3000
Corequisite: MECH4000 *or* MECH4003, 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: Prof H Kaebernick
CP6 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.

MECH4003
Thesis 1
Staff Contact: Dr M Chowdhury
CP15 S2 T6
Corequisite: MECH4001
Note/s: Excluded MECH4000

To be taken in the second last session required for the completion of all requirements for the award of the degree. This subject, together with MECH4004 Thesis 2, which is to be taken in the following session, requires each student to demonstrate managerial, technical and professional skills in planning and executing an approved engineering project within a stipulated time limit. Each student is also required to report on their project work at a thesis conference which is organised under MECH4001 Communications for Professional Engineers. Each student is guided by a supervisor, but successfully planning, executing and reporting on the project is the sole responsibility of each student. This subject does not require the submission of a thesis document.

MECH4004
Thesis 2
Staff Contact: Dr M Chowdhury
CP15 S1 T6
Prerequisite: MECH4003
Note/s: Excluded MECH4000

To be taken in the last session required for the completion of all requirements for the award of the degree, i.e. in the session immediately following that in which MECH4003 Thesis 1 is taken. This subject, together with MECH4003 Thesis 1, requires each student to demonstrate managerial, technical and professional skills in planning, executing and reporting on an approved engineering project within a stipulated time limit. The project which each student works on will be a direct continuation of the project which that student worked on in MECH4003 Thesis 1. 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.

MECH4090
Industrial Training
Staff Contact: A/Prof K Hoang
CP0 S1
Prerequisite: MECH2000

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.

MECH4120
Design Technology
Staff Contact: A/Prof RB Frost
CP7.5 SS HPW3
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.

MECH4131
Advanced CAD Modelling and Applications
Staff Contact: Mr AJ Barratt
CP7.5 SS HPW3
Note/s: Excluded MECH9131 Quota restrictions apply

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 RA Platfoot
CP7.5 SS HPW3
Prerequisite: MECH2100
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

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 mechatronic systems. Revision of control engineering concepts in the continuous time domain; theory of discrete time control system. z-transforms; mathematical modelling of mechatronic systems in the 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 RA 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 RA Willgoss
CP7.5 S1 HPW3
Prerequisites: MECH3200, MECH3212, MECH3530 *or* 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. 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 RB 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 JE Baker
CP7.5 SS HPW3
Prerequisite: MECH3300

Three-dimensional kinematics and kinetics of a particle and a rigid body: coordinate transformations, finite and infinitesimal 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 JE Baker
CP7.5 SS HPW3
Prerequisite: MECH2320 *or* 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 RB Randall
CP7.5 SS HPW3
Prerequisite: MECH3330 *or* 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 JM 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 JM 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 EJ 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 HPW3
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 nonlinear fracture mechanics. Residual strength diagram. Crack growth analysis. Damage tolerance analysis. Fracture control. Applications.

MECH4410
Engineering Applications of Finite Elements
Staff Contact: A/Prof DW Kelly
CP7.5 SS HPW3
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.

MECH4440
Theory of Plasticity
Staff Contact: Dr CV Madhusudana
CP7.5 SS HPW3
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. Reynoldsì Transport theorem. Stress in fluid motion. Cauchyìs 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
Internal Combustion Engines
Staff Contact: School Office
CP7.5 SS HPW3
Prerequisite: MECH3701
Note/s: Excluded MECH9761

IC engine operation. Basic parameters for IC engine analysis.Importance of cycle analysis. Conversion of experimental pressure traces to p-v diagrams. Use of differentiated pressure traces for engine diagnostics. Review of air-standard cycles in relation to real engine cycles for reciprocating engines and gas turbines. Engine control, supercharging, turbocharging analysed via air-standard cycles. Review of thermodynamic properties and gas dynamics. Modification of engine cycles for high temperature thermodynamic properties and compressible flow processes. Wave motion in reciprocating engines. Turbomachinery in reciprocating engines and gas turbines. Modelling of combustion in engines. Heat transfer in engines. Applicable heat transfer models. Control of emissions from engines.

MECH4720
Solar Energy
Staff Contact: Prof GL Morrison
CP7.5 SS HPW3
Prerequisites: 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 HPW3
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.

MECH9000
Research Thesis Mechanical and Manufacturing Engineering (Full time)
Staff Contact: A/Prof M Behnia

MECH9001
Research Thesis Mechanical and Manufacturing Engineering (Part time)
Staff Contact: A/Prof M Behnia

MECH9010
Project
Staff Contact: Dr K Zarrabi
CP30
Note/s: The project must be completed in no more than two sessions

MECH9120
Design Technology
Staff Contact: A/Prof RB Frost
CP15 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.

MECH9131
Advanced CAD Modelling and Applications
Staff Contact: Mr AJ Barratt
CP15 SS HPW3
Note/s: Excluded MECH4131 Quota restrictions apply

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 RA Platfoot
CP15 SS HPW3
Prerequisite: MECH2100 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 MJ Tordon
CP15 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 MJ Tordon
CP15 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 RA Willgoss
CP15 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 RA Willgoss
CP15 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 RA Willgoss
CP15 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
CP15 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 RA Willgoss
CP15 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 RA Willgoss
CP15 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 RA Willgoss
CP15 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 JE Baker
CP15 SS HPW3
Prerequisite: Assumed knowledge MECH2320 *or* 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 JE Baker
CP15 SS HPW3
Prerequisite: Assumed knowledge MECH2320 *or* 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 RB Randall
CP15 SS HPW3
Prerequisite: Assumed knowledge MECH3330 *or* 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 RAJ Ford
CP15 SS HPW3
Prerequisite: Assumed knowledge MECH2320 *or* MECH2300, MATH2009 *or* equivalent
Note/s: Excluded MECH3310 *and* MECH3330

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 JM Challen
CP15 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 sound source by the direct and the comparison method. Measurements of the sound power levels of a sound source by the intensity method. Tape recording of noise and vibration signals. Using accelerometers.

MECH9323
Environmental Noise
Staff Contact: Prof KP Byrne
CP15 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 KP Byrne
CP15 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 JM Challen
CP15 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 JM Challen
CP15 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 EJ Hahn
CP15 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
CP15 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 DW Kelly
CP15 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.

MECH9440
Plasticity Theory and Applications
Staff Contact: Dr CV Madhusudana
CP15 SS HPW3
Prerequisite: MECH3400 or equivalent
Note/s: Excluded MECH4440

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. Limit analysis.

MECH9610
Advanced Fluid Dynamics
Staff Contact: A/Prof E Leonardi
CP15 SS HPW3
Prerequisite: MECH3600 or equivalent
Note/s: Excluded MECH4600, MECH4610, MECH4710, MECH9710

Review of vector analysis and cartesian tensors. Kinematics 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
CP15 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
CP15 SS HPW3
Prerequisite: Assumed knowledge MECH3520, 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 GL Morrison
CP15 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
CP15 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. Laboratory experiments.

MECH9740
Power Plant Engineering
Staff Contact: A/Prof M Behnia
CP15 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
CP15 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
CP15 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 idealised surfaces. Interaction of radiation with conduction and convection. Heat transfer analysis of selected industrial problems. Laboratory experiments.

MECH9751
Refrigeration and Air Conditioning 1
Staff Contact: A/Prof E Leonardi
CP15 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
CP15 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 IL Maclaine-cross
CP15 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 IL Maclaine-cross
CP15 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
CP15 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
CP15 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 IL Maclaine-cross
CP15 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: School Office
CP15 SS HPW3
Note/s: Excluded MECH4700

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: School Office
CP15 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 JE Baker
CP15 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; linearisation of engineering problems; stability of engineering systems.

MECH9920
Special Topic in Mechanical Engineering
CP15 SS HPW3

MECH9930
Special Topic in Mechanical Engineering
CP15 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: Mr PJ Helmore
CP7.5 F HPW15
Corequisites: NAVL3600, NAVL3610

Development of ship and ship building. Ocean environment. Trading environment. Ship operations. Ship types. Freeboard. Tonnage. Mathematics of ship design: optimisation techniques. Mathematical modelling.

NAVL3400
Ship Structures 1
Staff Contact: Dr M Chowdhury
CP10 F HPW2
Prerequisites: MATH2009, MATS9520, MECH2412
Corequisite: MECH3400

Introduction to rationally-based structural design and optimisation. 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 PJ Helmore
CP12.5 F HPW2.5
Prerequisites: MATH1231 *or* MATH1241, MECH1300, MECH1500, PHYS1918

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 LJ Doctors
CP12.5 F HPW2.5
Prerequisites: MATH2009, MECH2320 *or* MECH2300, MECH3330 *or* 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.

NAVL4100
Principles of Ship Design 2
Staff Contact: A/Prof LJ 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 LJ 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 PJ Helmore
CP20 F HPW4
Prerequisites: NAVL3600, NAVL3610

Components of ship resistance. Froude's law and laboratory tests. Practical resistance prediction. 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.

School of Mining Engineering

Head of School
Professor JM Galvin

Administrative Assistant
Ms Carol Vallance

Mining Engineers plan, design, construct, operate and manage mines producing coal, metallic ores and other precious or semi-precious minerals. They also manage the people and the substantial financial resources invested in mining projects.

Mining engineering is an international profession with Australiaís big mining companies operating in South East Asia, Africa, South and North America and Europe, and our graduates have the opportunity to travel a great deal in their work. Mining Engineering graduates are trained to be versatile, adaptable and responsive to change in a physically and mentally challenging career.

Subsequent to graduation many take a mine manager's or lower ranking supervisor's examination or 'ticket' after 1–3 years work experience in mines. Initially in charge of a small section of a mine they take increasingly responsible positions, managing mines with between 300–400 employees and annual turnovers of more that $100 million. They can then progress to the management of larger or more diverse mines and mining complexes, reaching the top levels of mining industry management.

Mining engineers also work as government mine inspectors, mining systems and computing engineers, geotechnical engineers, explosives and blasting engineers, design specialists in mine ventilation mine safety environment, mineral processing, mining equipment design and supply, mining finance and banking, investment and valuation analysis. They also work in mining research and education, holding senior academic and research positions in some of the world's top tertiary institutions.

The mining engineering course involves a strong grounding in basic sciences, engineering principles and management as a foundation to training for production and mine management functions. The course also provides a good appreciation of the science of geology, the technology of mineral processing and the economics of resources so that the mining engineer can effectively work in any section of the mining industry from evaluation of ore reserves to marketing and finance.

The School offers formal postgraduate courses plus ongoing professional development short courses. These include the range of subjects and courses previously offered by the Key Centre for Mines which has now been fully integrated within the School of Mining Engineering.

Undergraduate Study

Course Outlines

The School offers a 4 year full-time course in Mining Engineering leading to the award of the degree of Bachelor of Engineering at Pass or Honours level. A five-year combined degree course is also available in Civil Engineering and Mining Engineering and a fast track Master of Commerce degree is also available to students who have maintained at least a credit average in their first three years of the Mining Engineering Course.

After graduation, mining engineers who choose to develop careers in production management, will be required to gain further practical experience before obtaining a Mine Manager's Certificate of Competency, in either Coal or Metalliferous Mining. These statutory certificates of competency are issued by the State Department of Industrial Relations, which in the case of New South Wales coal mining comes under the Coal Mines Regulation Act No. 67, 1982, and for metalliferous mining under the Mines Inspection Act No. 75, 1901, as amended.

Arrangements have been made with the Universities of Newcastle and Tasmania for students who have completed a specified program at these institutions to be admitted with advanced standing to Year 3 of the Mining Engineering degree course at the University of New South Wales.

Students or graduates of other engineering disciplines may also be given suitable advanced standing for conversion to Mining Engineering.

3140
Bachelor of Engineering
BE

Year 1 of the course is similar to that of several other Engineering courses and Year 2 includes those subjects which are of common relevance to the Engineering disciplines. Year 3 is largely devoted to basic mining subjects and Year 4 provides advanced instruction in subjects essential to all mining engineers. In addition, the fourth year offers a wide range of elective subjects, allowing students, if they so wish, to concentrate their studies on a particular sector of the industry, such as coal mining or metalliferous mining. An important fourth year requirement is for students to undertake personal research or a study project in mining or minerals engineering on which they are required to submit a thesis for examination. A number of general education subjects are also prescribed for the last three years.

Some subjects in Years 3 and 4 of the course will be conducted at the School's residential MinesiteTeaching Unit located at Wyee Coal Mine. This provides a unique opportunity for students to gain immediate practical insight into the application of theoretical concepts. For the award of Honours at the conclusion of the full-time course, students will need to have distinguished themselves in the formal work, in other assignments as directed by the Head of School, and in the final year project.

In the undergraduate course it is compulsory for students to gain practical experience in the mining industry during successive long recesses. A minimum of 100 days needs to be completed before graduation. The School assists students as much as possible in securing suitable vacation employment.

		HPW S1	HPW S2	CP
Year 1				
CHEM1807	Chemistry 1 ME	0	4	10
MATH1131 / MATH1141	Mathematics 1A or Higher Mathematics 1A	6	0	15
MATH1231 / MATH1241	Mathematics 1B or Higher Mathematics 1B	0	6	15
MINE0010	Applied Mechanics	3	0	10
MINE0110	Stress Analysis 1	0	3	10
MINE0210	Introduction to Mining Engineering	1	1	7.5
MINE0410	Technical Communication	0	3	7.5
MINE0710	Computing 1	2	0	7.5
PHYS1002	Physics 1	6	6	30
Total HPW Session 1	**18**			
Total HPW Session 2	**23**			
Total Credit Points	**112.5**			

		HPW S1	HPW S2	CP
Year 2				
ELEC0807	Electrical Engineering 1E	0	3	10
GEOL5211	Geology for Mining Engineers 1	2	2	10
GMAT0441	Surveying for Engineers	0	4.5	15
MATH2009	Engineering Mathematics 2	4	4	20
MATH2819	Statistics SA	2	2	10
MATS9421	Materials for Mining Engineers	3	1	10
MINE0120	Stress Analysis	3	0	10
MINE1320	Fluid Mechanics and Thermodynamics	0	3	10
MINE0220	Introduction to Mining Engineering 2	2	0	7.5
PHYS2920	Electronics	3	0	7.5
General Education subjects		2	2	15
Total HPW Session 1	**21**			
Total HPW Session 2	**21.5**			
Total Credit Points	**125**			

		HPW S1	HPW S2	CP
Year 3				
GEOL5311	Geology for Mining Engineers 2	3	3	20
GMAT0580	Mining Surveying	3	0	7.5
MINE1131	Mining of Metalliferous Deposits	0	3	10
MINE1132	Mining of Coal Deposits	0	3	10
MINE1231	Rock Mechanics	0	4	15
MINE1232	Soil Mechanics	2	0	7.5
MINE1330	Bulk Materials Handling and Transport	0	2	7.5
MINE1530	Power Supply in Mines	0	2	7.5
MINE1635	Excavation Engineering	3	0	10
MINE1830	Mine Ventilation and Environment	4	0	5
MINE7342	Minerals Engineering Processes	2	2	12.5
General Education subjects		2	2	15
Total HPW Session 1	**19**			
Total HPW Session 2	**21**			
Total Credit Points	**132.5**			

Year 4				
MINE1140	Geotechnical Engineering	4	0	15
MINE1740	Mining Legislation	0	2	7.5
MINE1930	Industrial Training	0	0	0
MINE1940	Tunnel Engineering and Shaft Sinking	2	0	7.5
MINE2141	Mineral Economics	2	0	7.5
MINE2142	Mine Planning and Design	0	6	20
MINE2240	Mining Management	0	3	10
MINE3040	Mine Safety Engineering	3	0	10
MINE3041	Hazard and Risk in Mining	2	0	7.5
MINE4140	Minerals Industry Project	4	4	22.5
MINE4240	Industrial and Research Seminars	1	1	7.5
MINE4540	The Mining Engineering Profession in Society	0	2	7.5

together with an advanced elective subject selected from the following:

Advanced Electives				
MINE7440	Mineral Process Technology	2	0	7.5
MINE3140	Computational Methods in Geomechanics	2	0	7.5
MINE3240	Operations Research	2	0	7.5
Total HPW Session 1	**20**			
Total HPW Session 2	**18**			
Total Credit Points	**130**			

BE(Mining Engineering)/MCom Fasttrack Program

Students who have maintained at least a Credit average over the first 3 years of the Mining Engineering Course may elect to join this program at the end of year 3. After completing the fourth year program shown below, a student is eligible to graduate at the end of year 4 with a BE in Mining Engineering.

To complete the requirements of an MCom, an additional 8 15CP subjects are selected from the MCom program with the provision for gaining a single major or a double major. This specialisation will determine the Commerce Core Elective in year 4.

		HPW S1	HPW S2	CP
Year 4				
ACCT5901	Accounting: A User Perspective	0	3	15
ECON5103	Business Economics	3	0	15
Commerce Core Elective		0	3	15
MINE1140	Geotechnical Engineering	4	0	15
MINE1740	Mining Legislation	0	2	7.5
MINE2141	Mineral Economics	2	0	7.5
MINE2142	Mine Planning and Design	0	6	20
MINE2240	Mining Management	0	3	10
MINE3040	Mine Safety Engineering	3	0	10
MINE3041	Hazard and Risk in Mining	2	0	7.5
MINE4140	Minerals Industry Project	4	4	22.5
Total HPW Session 1	**18**			
Total HPW Session 2	**18**			
Total Credit Points	**135**			

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 Mining Engineering 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.

Postgraduate Study

A number of coursework Masters degrees and Graduate Diplomas are available through the School of Mining Engineering. In addition, the School offers the research degrees of Doctor of Philosophy PhD in Mining Engineering 1050 and Master of Engineering ME in Mining Engineering 2180 The research degrees may also be undertaken by staff employed full time in the industry over a longer duration.

Beginning Sesion 1, 1999, the Mining Industry Management program will replace the current Master of Mining Management course offered through the Key Centre for Mines which will not be available beyond the end of 1998.

For further information on the above courses, please contact the Postgraduate Course Advisor in the School of Mining Engineering.

Course Outlines

8055
Mining Engineering
Master of Engineering Science
MEngSc

It is anticipated that two specialist MEngSc coursework programs will be available commencing Session 1, 1999.

The two specialist programs proposed will be:

Master of Engineering Science (Mining Geomechanics)

Master of Engineering Science (Mining Industry Management)

These programs will be 120 credit point programs consisting of core and elective subjects. The majority of subjects offered will be presented in short course format enabling full time or part time enrolment.

5040
Mining Engineering
Graduate Diploma
GradDip

The Graduate Diploma course in Mining Engineering serves two purposes. It can provide a professional introduction to the mining industry for graduates in Science and Technology or Engineering and it as a qualifying course for entry to the Master of Engineering Science or Masters by Research programs.

The Graduate Diploma will be awarded after successful completion 90 credit points of coursework, either full time or part time. A majority of the subjects will be offered as modules over a short period to permit mineral industry personnel to attend on a part-time basis.

The level of the Graduate Diploma is designed to be equivalent to a four-year honours degree.

For further information on the Graduate Diploma, please contact the Postgraduate Course Advisor in the School of Mining Engineering.

Subject Descriptions

MINE0010
Applied Mechanics
Staff Contact: Dr JO Watson
CP10 S1 L2 T1

Statics: definition of force; free body diagrams; static equilibrium of rigid body; statical equivalence of systems of forces; centre of mass, centroid, centre of pressure; friction: clutch, screwjack, belt drive. Kinematics: rectilinear and angular motion; motion in a plane; relative displacement, velocity and acceleration; gear trains and linkages. Dynamics: equations of motion for particle and rigid body; work and energy; impulse, momentum and impact.

MINE0110
Stress Analysis 1
Staff Contact: Dr JO Watson
CP10 S2 L2 T1

Structures: forces and stresses in pin jointed frames; bending moment, shear force in beams; stress due to bending of beams; deflection of beams; buckling of struts; stress due to torsion of shafts; combined axial and bending stress; stress in thin walled pressure vessels. Stress and strain: definition of stress in three dimensions; stress transformation in two dimensions; principal stresses in two dimensions. Mohrís circle of stress; definition of strain in three dimensions; strain-displacement relations in two dimensions; Mohrís circle of strain; principal strains in two dimensions; electrical and mechanical methods for measurement of strain; isotopic elasticity.

MINE0120
Stress Analysis 2
Staff Contact: Dr JO Watson
CP10 S1 L2 T1
Prerequisite: MINE0110

Structures: shear stresses in beams; bending moment and shear force in continuous beams; slope-deflection equations and fixed end moments; stiffness matrix and generalised nodal force vector; computer programs for analysis of continuous beams. Stress and strain: stress transformation and principal stresses in three dimensions; strain-displacement relations in three dimensions; strain transformation and principal strains in three dimensions; equations of equilibrium in terms of stress; boundary conditions; Navier equations; strain compatibility and the Airy stress function; stress in thick walled tubes under pressure; stresses around circular tunnel; anisotropic elasticity; the equivalent continuum; yield criteria; the stress space; strain hardening and softening; flow rules; viscoplasticity.

MINE0130
Principles of Mining
Staff Contact: Prof JM Galvin
CP7.5 S2 L1 T1

Mining engineering terminology and definitions. Drilling techniques for production blasting and exploration. Explosives and rock fragmentation processes. Mine development, access to mineral deposits and their exploitation. Surface and underground techniques. Methods of working coal and metalliferous deposits. Methods of ground support. Offshore mining; the ventilation and drainage of mines; mine transport and materials handling. Mine safety engineering.

MINE0210
Introduction to Mining Engineering
Staff Contact: Prof JM Galvin
CP7.5 S3 L1
Note/s: Visits to mines and related undertakings are a requirement of this subject

Mining in Australia. Performance and requirements of mining in relation to the natural environment. Mineral deposits, metallic, non-metallic and fuels. Elements of prospecting and exploration. The geological environment of mining. Basic mining techniques and methods. Mining equipment and services. Mineral benefication. Relevance of the basic science and engineering disciplines to the mining industry.

MINE0220
Introduction to Mining Engineering 2
Staff Contact: Mr D Chalmers
CP7.5 S1 L1 T1
Prerequisite: MINE0210
Note: Visits to mines and related undertakings are a requirement of this subject

Exploration. Development of mines, infrastructure requirements; environmental assessment. Ore body parameters for surface and underground mines; stratified and non-stratified deposits; mine layout for surface and underground operations; underground access; introduction of techniques of rock breakage and support for coal and metal mines; processing of minerals; disposal of overburden and rejects rehabilitation. Engineering hydrology, sources of mine water, forecasting water inflows, drainage.

MINE0410
Technical Communication
Staff Contact: Dr CR Daly
CP7.5 S1 L1 T1

Writing and presentation of reports, resumes. Analysis of experimental data. Presentation of graphs and figures. Oral presentation styles. Communications. Computer graphic presentation packages.

MINE0710
Computing 1
Staff Contact: Dr CR Daly
CP7.5 S1 L1 T1

Introduction to hardware and operating systems; application software: word processing, spreadsheets, databases. Programming languages. Use of microcomputers for control, monitoring and data acquisition.

MINE1131
Mining of Metalliferous Deposits
Staff Contact: A/Prof D Laurence
CP10 S2 L3
Prerequisites: MINE0210, MINE0220, GEOL5211

Geology, mineralogy and physical characteristics of a mineral deposit. Mineralisation inventory: maps and sections. Determination of reserves. Choice between surface and underground mining: selection criteria. Mining methods in surface and underground operations. Mining sequence. Production planning and scheduling. Equipment selection: systems approach; types of equipment; selection of type, capacity and number. Mining and ancillary operations. Productivity and operating costs. Health and safety. Communications and control. Rehabilitation.

MINE1132
Mining of Coal Deposits
Staff Contact: Mr D Chalmers
CP10 S2 L3
Prerequisites: MINE0210, MINE0220, GEOL5211

Geological factors, physical and mechanical characteristics of the seam, roof and floor. Maps and sections. Determination of reserves. Choice between surface and underground mining methods: selection criteria. Mining methods for surface and underground operations. Impact of surface constraints. Production planning and scheduling. Mining geometrics. Stability and support. Equipment selection: systems approach; types of equipment; selection of type, capacity and number. Mining and ancillary operations. Productivity and operating costs. Health and safety. Communications and control. Rehabilitation.

MINE1140
Geotechnical Engineering
Staff Contact: Prof BK Hebblewhite
CP15 S1 L2 T2
Prerequisites: MINE1231, MINE1232

Stresses around mine excavations. Control of ground in the vicinity of underground excavations; bord and pillar, longwall and hard rock. Rock support and reinforcement. Theories of support design including pillars, roadway and longwall supports. Monitoring performance of structure. Energy changes accompanying underground mining. Rock bursts. Outbursts. Mining subsidence: characteristics, effects. prediction and control. Rock slopes: failure mechanisms, stability analyses and design. Application of computer techniques for rock mechanics problems. Laboratory experiments.

MINE1231
Rock Mechanics
Staff Contact: Prof BK Hebblewhite
CP15 S2 L2 T2
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, MINE0120

Rock mass, rock material and discontinuities: Geomechanical properties of discontinuities: orientation, spacing, persistence, roughness, aperture, filling. Rock mass classification. Rock strength and deformability: concepts and definitions, strength tests, deformability tests by static and dynamic methods, influence of time. Strength criteria for isotropic and anisotropic rock material, shear behaviour of discontinuities, behaviour of rock masses containing discontinuities. Pre-mining state of stress and its measurement. Laboratory experiments.

MINE1232
Soil Mechanics
Staff Contact: Dr JO Watson
CP7.5 S1 L1 T1
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, MINE0120

Soil description and classification; engineering behaviour of soils; basic definitions in soil mechanics, effective stress concept; shear strength of soils, soil permeability, flow of water in soils, consolidation, stresses in soil from external loading; design of shallow foundations, compaction, compaction control, pavement and haul-road design, lateral earth pressures, soil slope stability, expansive and dispersive soils, filter design.

MINE1320
Fluid Mechanics and Thermodynamics
Staff Contact: Dr JO Watson
CP10 S2 L2 T1
Prerequisites: MINE0010, MINE0110, PHYS1002, MATH1032 or MATH1231 or MATH1042 or MATH1241
Corequisite: MATH2001

Fluid mechanics: properties, fluid statics, laminar and turbulent flow. Newtonian and non-Newtonian fluids. Continuity equation, energy equation, momentum equation. Dimensional analysis. Flow measurement. Energy losses in pipelines and open channels. Fluid dynamics of suspensions. Permeability. Thermodynamics: states, processes and properties. Energy of a system: first and second laws of thermodynamics. Reversibility, ideal gas laws, cycles for heat engines, heat pumps, compressors and refrigerators. Psychrometrics. Laboratory experiments.

MINE1330
Bulk Materials Handling and Transport
Staff Contact: A/Prof D Laurence
CP7.5 S2 L15 T5

Transport systems for minerals, waste and supplies. Descriptions and power requirements for: conveyors (belt and chain), rope haulage systems, free steered vehicles and locomotive haulage systems. Descriptions and pressure loss calculations for hydraulic and pneumatic

transport systems. Mine winding systems for shafts: mechanics for hoisting; winding cycle diagrams; power requirements. Safety aspects and maintenance programs for haulage and winding systems.

MINE1530
Power Supply in Mines
Staff Contact: Dr CR Daly
CP7.5 S2 L1 T1
Prerequisites: MINE1320, PHYS2920,

Electric power distribution, mine cables, switchgear. Flame-proofing and intrinsic safety, fault protection, risk analysis. Oil hydraulic power. Components and circuits. Pumps, motors, valves. Compressed air.

MINE1635
Excavation Engineering
Staff Contact: Mr D Chalmers
CP7.5 S1 L2 T1

Percussive, rotary and hydraulic rock drilling equipment: applications and operating principles, maintenance. Drilling methods: in-the-hole hammer, diamond core, overburden, Odex. Theories of rock fragmentation by blasting. Types of explosives and their properties. Various initiation systems. Blasting accessories and their applications. Blast design in various underground and surface mining operations. Blasting hazards and precautionary measures. Protection of structures against blast induced ground vibrations and airblast. Alternatives to conventional explosives. Principles of coal and rock cutting mechanics. The performance of picks and free rolling cutters. Cutting tool interaction. The design of cutting arrays for machine mining and tunnelling. Impact breakage of rock. Cutting tool materials and the effects of wear. Methods of assessing rock cuttability. Exotic methods of rock breakage.

MINE1740
Mining Legislation
Staff Contact: Prof JM Galvin
CP7.5 S2 L2

An appreciation of the laws relating to coal and metal mining practice and to safety, health and environment in mining.

MINE1830
Mine Ventilation and Environment
Staff Contact: Prof JM Galvin
CP12.5 S1 L2 T2
Prerequisites: MINE0210, MINE0220, MINE1320

Mine ventilation: practice in mines, forces causing airflow, resistance of workings and distribution of mine air, network analysis, fans and their operation, auxiliary ventilation, economic size of airways; ventilation surveys. Mine environment: mine gases; hazards, occurrence, detection, monitoring and control, airborne dust; physiological effects, sampling, measurement and analysis, sources and control, mine climate; physiological effects, air cooling power, factors affecting mine climate and control. Ventilation planning: airflow requirements based on pollutant gas, airborne dust and heat.

MINE1930
Industrial Training
Staff Contact: Dr C Daly
CP0 L0 T0

Students are required to gain practical experience totalling no less than 100 days during successive long recesses and are required to submit for assessment a suitably presented report on their experience gained during the recess prior to their final year of study. Reports are to include a review of the operations of the company providing the experience and full details of the work carried out by the student. After appraisal by a Staff member and any required amendments, a copy is provided for the mine manager or other responsible person at the place of employment.

MINE1940
Tunnel Engineering and Shaft Sinking
Staff Contact: Dr P Hagan
CP7.5 S1 L2

Scope for tunnels. Geological investigation. Design of tunnels. Tunnelling methods: drilling and blasting; cut and cover; full face and part face boring machine; shield and immersed caisson. Tunnelling in difficult ground. Ground consolidation methods. Lining and support of tunnels. Debris removal, drainage and ventilation during tunnelling operations. Hazards in tunnelling. Shaft sinking methods: conventional; mechanical boring. Ground treatment by chemical injection and freezing methods. Problems in shaft sinking operations and how to resolve them. Economic considerations of every aspect during tunnelling and shaft sinking. A project.

MINE2141
Mineral Economics
Staff Contact: Dr P Hagan
CP7.5 S1 L2
Prerequisites: MINE1131, MINE1132

Commodities. Supply and demand. business cycles. Exchange rates. Metal markets and hedging. Project financing including: Joint Ventures. Types of capital. Company financial statements and reporting requirements. Feasibility studies and mine evaluation. Determination of cut-off grades. Smelter returns. Marketing and sales contracts.

MINE2142
Mine Planning and Design
Staff Contact: Prof BK Hebblewhite
CP20 S2 L3 T3
Prerequisites: MINE1131, MINE1132
Corequisite: MINE2141

Interpretation of exploration data. Sampling. Estimation of resource and reserves: traditional and geostatistical methods. Mine planning parameters. Mine design. Equipment selection. Productivity. Capital and operating costs. Mine design project.

MINE2240
Mining Management
Staff Contact: Dr CR Daly
CP10 S2 L2 T1

Approach to management study, management models, responsibilities, planning, decision making, leadership, communications, negotiations, delegation, motivation and case study of industrial relations. Total Quality Management. Maintenance Engineering. Management Information Systems. Occupational Health and Safety.

MINE3040
Mine Safety Engineering
Staff Contact: A/Prof D Laurence
CP10 S1 L15 T15
Prerequisites: MINE0210, MINE0220

Outburst in coal mines: occurrence, prediction and control. Mine explosions and their control methane, coal dust, sulphide dust. Mine fires and their control open fires, spontaneous combustion of coal and sulphide ores in underground mines, sealing off fires underground, fire fighting, recovery of sealed-off areas. Water in mines: inundations, inrushes, precautions. Radiation in mines: hazards, dosage, radon gas emission and sources, control of radiation. Safety in mines: accidents; types, causes, rates, prevention. Breathing apparatus; types, uses, physiological requirements. Emergency organisation and rescue work. Minersí diseases; prevention and treatment. Noise and its control in mines; properties of vibrations, measurement of sound, effects, sources, control. Illumination in mines; properties of light, light sources, illumination in underground and open cut mines, standards for mine lighting, photometry, design of lighting systems. Laboratory experiments.

MINE3041
Hazard and Risk in Mining
Staff Contact: Prof J Cross
CP7.5 S1 L2

Overview of risk management: quantifying risk and acceptable risk. Statistical methods for identifying potential for loss. Hazard and risk identification methodologies. Causes of accidents. Methods of quantifying risk: consequence modelling, fault trees, event trees. Methods of controlling risk and living with residual risk.

MINE3140
Computational Methods in Geomechanics
Staff Contact: Dr JO Watson
CP7.5 S1 L2
Prerequisites: MINE1231, MINE1232

Boundary value problems: review of strategies for solution, and limitations of analytical methods; finite differences. Finite elements: variational principle and finite elements for Poissonís equations; global and elemental stiffness matrices and equivalent nodal force vectors; matrix assembly and equation solution; variational principle and finite elements for elasticity; constant strain triangular element, isoparametric elements; design of meshes, error estimates; adaptive mesh refinement; computer program for elastic analysis of plain strain; elastoplasticity, elastoviscoplasticity. Boundary elements: fundamental solution and integral equations for Poissonís equation; isoparametric boundary elements; construction and solution of discrete systems of equations; direct boundary element method for elasticity; design of meshes; computer programs for elastic analysis of strain.

MINE3240
Operations Research
Staff Contact: Dr CR Daly
CP7.5 S1 L1 T1

Linear programming, decision analysis, queuing theory, simulation, forecasting, reliability, replacement, inventory and production, dynamic programming. Project management, use of project management software.

MINE4140
Minerals Industry Project
Staff Contact: Dr CR Daly
CP22.5 F T4

Candidates are required to submit a dissertation or thesis on a mining, minerals engineering or other topic approved by the Head of School. The work may take the form of an engineering analysis, experimental investigation, theoretical study or design project. Candidates may be required to present themselves for oral examination on the subject of their submission.

MINE4240
Industrial and Research Seminars
Staff Contact: Prof FF Roxborough
CP7.5 F L1

A series of seminars presented by invited speakers from within the university, other research establishments and selected industrial operations, covering special topics of current interest.

MINE4540
The Mining Engineering Profession in Society
Staff Contact: School of Mining Engineering Office
CP7.5 S2 L1 T1

The numerous sections of society with which mining engineers may interact and their diverse expectations; the potential for divided loyalty, mistrust and conflict. The consequences of mining engineers being employed as professionals; codes of ethics and their effectiveness; scepticism about the attitude of ëlimited responsibilityí. Possible future controls of the profession and industry. One of the following: (a) The potential impact of an international policy of sustainable development on the mineral industry and how it may be implemented; or (b) a systematic process of decision making, illustrated by assessment procedures for major projects and raising the issue of who would be involved; or (c) how responsible people outside the mineral industry see key problems associated with the industry in Australia. The subject will be taught via tutorials and a mini-project.

MINE7342
Minerals Engineering Processes
Staff Contact: School of Mining Engineering Office
CP12.5 F L1 T1

Objectives of mineral processing and coal preparation. Mine-mill interface. Properties of minerals and ores. Sampling and evaluation. Comminution: fracture, liberation, size criteria, energy-size relationships. Crushing and grinding. Screening and classifying. Concentration processes: density and other physical methods. Dissolution processes. Interfacial phenomena. Flotation. Liquid-solid separation: flocculation, thickening, filtration. Washability curves. Partition curves. Material balances. Performance prediction. Laboratory exercises.

MINE7440
Mineral Process Technology
Staff Contact: School of Mining Engineering Office
CP7.5 S1 L15T5

Feed characterisation: Float-sink separation, release analysis, tree procedure. Vector representation for samples: Mayer curves and release curves. Physics and chemistry of surfaces. Measurement of surface properties. On-stream and laboratory analyses and measurements. Laboratory and pilot testing. Flow-sheet design. Equipment selection and plant layout. Materials handling, storage and blending. Rejects and tailings disposal. Sampling: sampling theory, sources of error in sampling, design of sampling plants. Process optimisation and control.

School of Petroleum Engineering

Director:
Professor WV Pinczewski

The School is an autonomous unit within the Faculty of Engineering. Petroleum Engineering is a specialised engineering discipline which prepares graduates for a career in the oil and natural gas industries. Its related operations apply physical, mathematical and engineering principles to identify and solve problems associated with exploration, exploitation, drilling, production, processing, transportation and all the related economic and management problems associated with recovery of hydrocarbons from deep beneath the earthís surface.

The School of Petroleum Engineering offers both undergraduate degrees and postgraduate (by research) degrees as well as a formal graduate diploma.

The School has a four-year course leading to the award of a Bachelor of Engineering in Petroleum Engineering. It also offers a Combined Degree, BE Petr.Eng./M.Commerce which requires an additional three semesters after satisfactory completion of the Petroleum Engineering course.

Entry is normally into Year 1 of the program. The University has approved an arrangement whereby, upon recommendation of the Head of School, students who satisfy the requirements of the first two years of the Chemical Engineering, Mechanical Engineering, Civil Engineering or Mining Engineering degree courses at the University may be admitted into the final two years of the BE degree course in Petroleum Engineering. Such students would complete an appropriately modified Year 3 program as approved by the Head of School.

The University has also approved an arrangement whereby, upon the recommendation of the Head of School, students who satisfy the requirements of the first two years of the Chemical, Mechanical, Civil or Mining Engineering full-time degree courses at any other Australian tertiary institution may be admitted to the final two years of the Petroleum Engineering course. Such students will be required to undertake an appropriately modified Year 3 program as approved by the Head of School. Acceptance into the course will be on the basis of academic merit. This applies equally to students from accredited tertiary institutions in other countries.

For the award of Honours in Petroleum Engineering degree courses, students need to have distinguished themselves in the formal work, as well as in related assignments as directed by the Director of the School.

Undergraduate Study

Course Outline

3045
Petroleum Engineering – Full-time Course

Bachelor of Engineering
BE

		HPW S1	HPW S2	CP
Year 1				
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
CHEN1020	Engineering 1 CE+	6	6	30
MATH1131	Mathematics 1A or			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B or			
MATH1241	Higher Mathematics 1B	0	6	15
PHYS1002	Physics 1	6	6	30
General Education subject/s		0	2	7.5
Total HPW Session 1	**24**			
Total HPW Session 2	**26**			
Total Credit Points	**127.5**			

Year 2				
CEIC2010	Instrumental Analysis	3	3	15
CEIC2020	Computing	1	2	7.5
CEIC2030	Applied Thermodynamics and Rate Processes	2.5	0	6.5
CEIC2040	Applied Electrochemical and Surface Processes	1.5	0	4
CHEN2010	Material and Energy Balances	2	2	10
CHEN2020	Flow of Fluids	2	2	10
CHEN2030	Heat Transfer	0	3	7.5
CHEN2040	Mass Transfer Fundamentals	0	2	5
CHEN2050	Chemical Engineering Laboratory 1	0	2	7.5
ELEC0807	Electrical Engineering1E	0	3	7.5
GEOL5301	Introduction to Petroleum Geology	3	0	7.5
INDC2050	Physical Process Laboratory	2	0	5
MATH2021	Mathematics 2	2	2	15
MATH2819	Statistics SA	2	2	10
General Education subject/s		2	2	15
Total HPW Session 1	**23**			
Total HPW Session 2	**25**			
Total Credit Points	**133**			

		HPW S1	HPW S2	CP
Year 3				
APSE0002	Social Issues in Applied Science*	2	0	5
CHEN3040	Separation Processes	2	2	10
CHEN3061	Process Plant Engineering 1	4	3	17.5
CIVL0616	Structures	3	0	7.5
GEOL5312	Petroleum Geology and Geophysics	0	3	7.5
INDC3070	Instrumentation and Process Control 1	0	3	7.5
MATH3021	Mathematics	2	2	15
PTRL3001	Reservoir Rock Properties and Fluid Flow in Porous Media	2	0	5
PTRL3002	Rock and Fluid Properties Laboratory	3	0	7.5
PTRL3003	Petroleum Thermodynamics	2	0	5
PTRL3004	Drilling and Production Laboratory	0	3	7.5
PTRL3006	Drilling Fluids and Cementing	0	3	7.5
PTRL3007	Reservoir Engineering 1	0	2	5
PTRL3009	Fundamentals of Drilling Engineering	2	0	5
PTRL3106	Introduction to Formation Evaluation	1	0	2.5
PTRL3107	Formation Evaluation 1	0	3	7.5
Total HPW Session 1	**23**			
Total HPW Session 2	**24**			
Total Credit Points	**122.5**			

Year 4				
CHEN4030	Safety and Environmental	2	0	5
CHEN4070	Process Dynamics and Control	3	2	12.5
PTRL4080	Design Project	1	2	12.5
GEOL5401	Petroleum Production Geology	2	0	5
PTRL4001	Reservoir Simulation	0	2	5
PTRL4002	Advanced Recovery Methods	0	2	5
PTRL4003	Well Pressure Testing	2	0	5
PTRL4004	Advanced Drilling Engineering	3	0	7.5
PTRL4016	Well Completion and Stimulation	0	2	5
PTRL4026	Petroleum Production Engineering	0	2	5
PTRL4007	Reservoir Engineering 2	0	2	5
PTRL4018	Petroleum Economics 1	2	0	5
PTRL4028	Petroleum Economics 2	0	1	2.5
PTRL4105	Formation Evaluation 2	2	2	10
PTRL4109	Petroleum Engineering Project	4	2	30

PTRL4011	Communication Skills for Engineers	2	0	5

Total HPW Session 1 23
Total HPW Session 2 20
Total Credit Points 125

Postgraduate Study

Formal courses in the Scool of Petroleum Engineering lead to the award of the Graduate Diploma in Engineering (Petroleum) 5031.

The School welcomes enquiries from graduates interested in pursuing research for the award of the degrees of PhD and ME.

5031

Graduate Diploma in Engineering (Petroleum) GradDip

The oil industry has, in the past, employed personnel who, although working as Petroleum Engineers, have no formal qualifications in petroleum engineering.

The Diploma Program in Petroleum Engineering is designed to provide these people with a means of obtaining formal qualifications in a short, intensive, full-time study program over one academic year.

The course work, carried out under the guidance and supervision of academic Staff of the School, and in close cooperation with the oil industry, will incorporate a significant percentage of practical work in major areas of petroleum engineering.

Candidates for the program must hold a Bachelors Engineering or Science Degree and some relevant field experience in the industry. Acceptance into the program is at the discretion of the Director of the School of Petroleum Engineering.

The one year (two session) program course consists of the following subjects:

		HPW S1	HPW S2	CP
GEOL5301	Introduction to Petroleum Geology	3	0	12.5
GEOL5312	Geology of Petroleum Accumulations	0	3	7.5
PTRL5001	Reservoir Rock Properties	2	0	5
PTRL5002	Rock and Fluid Properties	3	0	7.5
PTRL5003	Well Pressure Testing	2	0	5
PTRL5004	Reservoir Simulation Fundamentals	0	2	5
PTRL5005	Petroleum Thermodynamics	2	0	5
PTRL5007	Reservoir Engineering	0	2	5
PTRL5008	Petroleum Production Economics	2	0	5
PTRL5009	Fundamentals of Drilling Engineering	2	0	5
PTRL5012	Drilling Fluids and Cementing	0	3	7.5
PTRL5016	Well Completion and Stimulation	0	2	5
PTRL5026	Petroleum Production Engineering	0	2	5
PTRL5106	Introduction to Formation Evaluation	1	0	2.5
PTRL5107	Formation Evaluation	0	3	7.5
PTRL5109	Petroleum Engineering Project	2	2	20

Total HPW Session 1 19
Total HPW Session 2 19
Total Credit Points 110

The School also offers courses that cover the areas of Reservoir Engineering, Drilling Engineering, Production Engineering and Formation Evaluation. Suggested course outlines are available from the Director of the School.

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.

APSE0002
Social Issues in Applied Science
Staff Contact: School Office
CP5 S1 L2

The subject covers social issues arising from future technological developments and the role that a professional applied scientist can play in influencing future directions. It will be taught by a combination of group activity, case studies, projects and seminars from visiting speakers, some of whom will be from disciplines other than the applied sciences.

PTRL3001
Reservoir Rock Properties and Fluid Flow in Porous Media
Staff Contact: Prof WV Pinczewski
CP5 S1 L2
Prerequisites: CHEN2020, MATH2021

Review of rock properties. Measurement of porosity, permeability and compressibility. Capillary tube model for a porous medium. Darcy's law. Steady-state, pseudo-steady state and unsteady state single phase flow. Fluid flow patterns. Well inflow equations. Well PI and skin factor. Ei-function solution for radial diffusivity equation. Constant terminal rate solution for the radial diffusivity equation. Constant terminal pressure solution for the radial diffusivity equation. Principle of superposition. Pressure build-up test for oil wells. Calculation of water influx. Numerical solutions for the radial diffusivity equation.

PTRL3002
Rock and Fluid Properties Laboratory
Staff Contact: A/Prof SS Rahman
CP7.5 S1 T3
Prerequisites: CHEN2010, CHEN2020

An integrated reservoir engineering and formation evaluation laboratory incorporating experiments in porosity, permeability, capillary pressure and resistivity of reservoir rocks and PVT properties of crude oil.

PTRL3003
Petroleum Thermodynamics
Staff Contact: Prof WV Pinczewski
CP5 S1 L2
Prerequisite: CEIC2030

Thermodynamic theory for phase behaviour of complex hydrocarbon mixtures at high temperature and pressure. Kinetic theory of gases, theory of liquids and liquid mixtures. Equations of State. Principle of corresponding states. Introduction to commercial phase behaviour and thermodynamic property evaluation packages used in the petroleum industry.

PTRL3004
Drilling and Production Laboratory
Staff Contact: A/Prof SS Rahman
CP7.5 S2 T3
Prerequisites: CHEN2010, CHEN2020

The program includes measurement and control of the basic properties of drilling fluids (density, viscosity, filtration, lubricity and electrochemical properties) and cement slurries (density, viscosity, filtration, thickening time and mechanical properties).

PTRL3006
Drilling Fluids and Cementing
Staff Contact: A/Prof SS Rahman
CP7.5 S2 L3
Prerequisites: PTRL3001, PTRL3009

Introduction to the basic functions and properties of drilling fluids and cement slurries. Composition and related properties of drilling fluids and cement slurries. Types of equipment and methods used in cementing operations. Drilling fluid displacement and replacement of cement slurries. Drilling hydraulics.

PTRL3007
Reservoir Engineering 1
Staff Contact: Dr P Wong
CP7.5 S2 L2
Prerequisite: PTRL3001

Multiphase fluid distribution. Relative permeability and capillary pressure. Capillary-gravity equilibrium. Multiphase flow. Reservoir material balance equations. Calculation of water influx from material balance. Recovery factor and the Buckley-Leverett equation.

PTRL3009
Fundamentals of Drilling Engineering
Staff Contact: A/Prof SS Rahman
CP5 S1 L2

Rotary drilling rig components. Drilling fluid circulating systems. Bottom-hole assemblies, well control and blowout prevention equipment and methods. Special marine equipment. Drilling cost analysis.

PTRL3106
Introduction to Formation Evaluation
Staff Contact: Dr HA Salisch
CP2.5 S1 L1

Concepts. Data Interpretation. Basic parameters and relationships. Environmental corrections for well logs. Log quality control. General purpose well logs, fluid and formation resistivities.

PTRL3107
Formation Evaluation 1
Staff Contact: Dr HA Salisch
CP7.5 S2 L3
Prerequisites: PTRL3106, GEOL5301

Formation Resistivities Porosity, lithology, saturation and permeability studies. Movable hydrocarbons. Shaly sand analysis. Wellsite and in-depth computer processed log interpretation. Data integration.

PTRL4001
Reservoir Simulation
Staff Contact: Prof WV Pinezewski
CP5 S2 L2
Prerequisites: PTRL3007, MATH3021

Development of reservoir simulation equations and their solution by finite-difference methods. Standard black oil models and their application to predicting reservoir behaviour. Hands-on use of commercial reservoir simulators: input data preparation, simulator operation, interpretation of simulator output.

PTRL4002
Advanced Recovery Methods
Staff Contact: Prof WV Pinczewski
CP5 S2 L2
Prerequisite: PTRL3007

A comprehensive review of secondary and tertiary oil recovery methods. Secondary water and gas flooding. Mechanisms of miscible and partially miscible displacements of oil and water related to enhanced oil recovery. Influence of phase behaviour on fluid displacement efficiency in surfactants, alcohol, hydrocarbon-miscible, and carbon dioxide flooding processes. Compositional numerical reservoir simulators. Field applications of EOR technologies.

PTRL4003
Well Pressure Testing
Staff Contact: Prof WV Pinczewski
CP5 S1 L2
Prerequisites: PTRL3007, MATH3021

Theory of transient well testing. Practical aspects of design and performance of field tests. Analysis of transient pressure data, effects of boundaries, reservoir heterogeneity, multiphase flow. Study of production, DST and formation interval tests. Pulse testing and multiwell tests. Computer assisted well test analysis techniques.

PTRL4004
Advanced Drilling Engineering
Staff Contact: A/Prof SS Rahman
CP7.5 S1 L3
Prerequisites: PTRL3004, PTRL3006, PTRL3009

Drilling methods and elements of rock mechanics. Rotary drill bits. Prediction of formation pore pressure and fracture gradients. Casing design. Directional drilling and deviation control. Coring practices. Fishing operations.

PTRL4007
Reservoir Engineering 2
Staff Contact: Dr P Wong
CP5 S2 L2
Prerequisites: PTRL3002, PTRL3003, PTRL3007

Aquifer Modelling. Estimating presence of aquifer and determination of aquifer constants (Qtd solutions). Review of Buckley Leverett theory characteristics and shock fronts. Pattern Floods (5 7 9 spots and line drive). Coning: Chierici solution. Pseudo functions of heterogeneous reservoirs. Hearn/Dykstra-Parsons models. Estimates of reservoir heterogeneity. Dykstra coefficient.

PTRL4010
Communication Skills and Business Practices for Engineers
Staff Contact: Dr HA Salisch
CP5 S1 L2
Prerequisites: All Year 3 subjects.

Communications skills. Preparation of resume. Background research for interviews and guidelines for conduct during interviews. Preparation of written reports and memorandums for maximum audience impact. Impromptu and prepared oral presentation skills.

Business Practices. Key oil industry methods of operation including joint ventures, contracts and relationships with specialist contractors. Role of Engineer in all types of petroleum industry companies including international majors, small domestic producers and service companies. realistic case studies based on industry experience and practices are included in all phases of this subject.

PTRL4016
Well Completions and Stimulation
Staff Contact: A/Prof SS Rahman
CP5 S2 L2
Prerequisites: PTRL3002, PTRL3004, PTRL3009

Reservoir considerations in well completion. Well completion designs. Basic types. Function and operation of subsurface equipment. Perforating. Sand control. Hydraulic fracturing. Acid treatment. Control of formation damage.

PTRL4018
Petroleum Economics 1
Staff Contact: Dr HA Salisch
CP5 S1 L2
Prerequisites: All Year 3 subjects.

Basic elements of profitability analysis. Depreciation, financial statements, interest, time value of money. The financial plan, outside share, planning and scheduling, pricing and costs. Profitability. Criteria, applications of present value profiles, risk and risk adjustment.

PTRL4026
Petroleum Production Engineering
Staff Contact: A/Prof SS Rahman
CP5 S2 L2
Prerequisites: PTRL3002, PTRL3004, PRL3006, PTRL3009

Introduction to multiphase flow in tubing. Design of sucker rod pumping systems. Design of gas lift and other lifting techniques. Design and operation of surface facilities associated with the primary processing of well head fluids: gathering systems, water separation, oil metering, gas dehydration and stripping. Compression. Pumping and pipeline facilities. Surface facilities associated with artificial lift.

PTRL4028
Petroleum Economics 2
Staff Contact: Dr HA Salisch
CP2.5 S2 L1
Prerequisite: PTRL4018

Introduction to government legislation and control. Jurisdiction over onshore and offshore petroleum resources. The basic title system. Allocation of permits and licenses. Expenditure commitments. Rental and royalty payments. Pipeline licenses. Discretionary government controls. Aboriginal land rights. Environmental acts and regulations.

PTRL4080
Design Project for Petroleum Engineers
Staff Contact: Dr HA Salisch
CP15 S1 T1 S2 T3
Prerequisites: All Year 3 subjects

The design project covers all aspects of the design of processing facilities for a potentially viable oil/gas field from conceptual design and environmental impact statement preparation through to a detailed design of processing facilities. Major emphasis is placed on the preparation of piping and instrumentation diagrams. Other topics include control schemes, a HAZOP analysis, equipment layout, main power and material requirements, and project schedule and economics.

PTRL4105
Formation Evaluation 2
Staff Contact: Dr HA Salisch
CP10 F L2
Prerequisites: PTRL3001, PTRL3107

Well logging in complex lithologies. Secondary porosity environment. Special purpose logging. The dipmeter. Formation and fluid sampling. Cementing quality monitoring. Well completions. Gun perforating. Logging in cased holes. Two case studies in Australian oilfields.

PTRL4109
Petroleum Engineering Project
Staff Contact: Dr HA Salisch
CP30 S1 T4 S2 T2

A major design or research project on a problem relevant to petroleum engineering and concluding in the submission of an individual thesis. Projects of relevance to the research efforts in the School plus approved topics of particular interest to industry.

PTRL5001
Reservoir Rock Properties and Fluid Flow in Porous Media
Staff Contact: Prof WV Pinczewski
CP5 S1 L2

Review of rock properties. Measurement of porosity, permeability and compressibility. Capillary tube model for a porous medium. Darcy's law. Steady-state, pseudo-steady state and unsteady state single phase flow. Fluid flow patterns. Well inflow equations. Well PI and skin factor. Ei-function solution for radial diffusivity equation. Principal of superposition. Pressure build-up test for oil wells. Calculation of water influx. Numerical solutions for the radial diffusivity equation.

PTRL5002
Rock and Fluid Properties Laboratory
Staff Contact: A/Prof SS Rahman
CP7.5 S1 L3

An integrated reservoir engineering and formation evaluation laboratory incorporating experiments in porosity, permeability, capillary pressure and resistivity of reservoir rocks and PVT properties of crude oil.

PTRL5003
Well Pressure Testing
Staff Contact: Dr HA Salisch
CP5 S1 L2

Theory of transient well testing. Practical aspects of design and performance of field test instrumentation. Pressure build-up tests. Pressure drawdown tests. Fall-off tests. Multi-rate tests. Gas well testing. Flow-after-flow. Isochronal and isochronal modified. Interference testing. Pulse testing. Drill stem tests. Fractured reservoir tests.

PTRL5004
Reservoir Simulation Fundamentals
Staff Contact: Prof WV Pinezeweki
CP5 S2 L2

Formulation of reservoir simulation equations. Explicit and implicit solution procedures. Cartesian and radial geometry. Single dimensional, two-phase flow. Commercial reservoir simulation software. Planning and execution of reservoir simulation projects. Use of reservoir simulation as a management and development tool.

PTRL5005
Petroleum Thermodynamics
Staff Contact: Prof WV Pinczewski
CP5 S1 L2

Thermodynamic theory for phase behaviour of complex hydrocarbon mixtures at high temperature and pressure. Kinetic theory of gases, theory of liquids and liquid mixtures. Equations of State. Principle of corresponding states. Introduction to commercial phase behaviour and thermodynamic property evaluation packages used in the petroleum industry and calculation of oil formation volume factors and dissolved gas ratios.

PTRL5007
Reservoir Engineering
Staff Contact: Dr P Wong
CP5 S2 L2

Basics of phase behaviour, equation of state modelling of gas-liquid systems, reservoir material balances. Identification of major recovery drive mechanisms. Water influx calculations. Well productivity.

PTRL5008
Petroleum Production Economics
Staff Contact: Mr WG Allinson
CP5 S1 L2

Economic reservoir analysis. Cash flow, time value of money, Venture profitability, valuation of oil and gas properties. Risk analysis.

PTRL5009
Fundamentals of Drilling Engineering
Staff Contact: A/Prof SS Rahman
CP5 S1 L2

Rotary drilling rig components. Drilling fluid circulating system. Bottom-hole assemblies, well control, blowout prevention equipment and methods. Marine equipment and drilling cost analysis.

PTRL5012
Drilling Fluids and Cementing
Staff Contact: A/Prof SS Rahman
CP7.5 S2 L3

Introduction to the basic functions and properties of drilling fluids and cement slurries. Composition and related properties of drilling fluids and cement slurries. Types of equipment and methods used in cementing operations. Drilling fluid displacement and replacement of cement slurries. Drilling hydraulics.

PTRL5016
Well Completion and Stimulation
Staff Contact: A/Prof SS Rahman
CP5 S2 L2

Reservoir considerations in well completion. Well completion designs. Basic types. Function and operation of subsurface equipment. Perforating. Sand control. Hydraulic fracturing. Acid treatment. Control of formation damage.

PTRL5106
Introduction to Formation Evaluation
Staff Contact: Dr HA Salisch
CP2.5 S1 L1

Concepts Data Integration Review of basic reservoir characteristics. Petrophysical parameters and relationships. Log quality control. The SP measurement. Gamma ray logs. Fluid resistivities.

PTRL5107
Formation Evaluation
Staff Contact: Dr HA Salisch
CP7.5 S2 L3

Formation Resistivities Porosity, lithology saturation and permeability studies. Movable hydrocarbons. Shaly sand analysis. Well site and in-depth computer processed log interpretation. Data integration.

PTRL5109
Petroleum Engineering Project
Staff Contact: Dr HA Salisch
CP20 S1 L2 S2 L2

A literature survey of a topic, approved by Director, of relevance to the research effort of the School and of practical interest to the oil industry. To be submitted as an individual thesis.

Graduate School of Biomedical Engineering

Head of School
Associate Professor BK Milthorpe

The Graduate School of Biomedical Engineering is an interdisciplinary unit which promotes and coordinates 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 Telecommunications, the School of Computer Science and Engineering and the School of Chemical Engineering and Industrial Chemistry offers concurrent courses in Mechanical Engineering/Biomedical Engineering 3683 Electrical Engineering/Biomedical Engineering 3727 Computer Engineering/Biomedical Engineering 3728 and in Chemical Engineering/ Biomedical Engineering 3043. 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

* All courses are subject to revision for 1999.

3043
Chemical Engineering/Biomedical Engineering
Full-time Course

Bachelor of Engineering Master of Biomedical Engineering
BE MBiomedE

Course 3043 is a concurrent BE in Chemical Engineering and Master of Biomedical Engineering. The course outline is given below.

		HPW S1	HPW S2	CP
Year 1				
BIOM1001	Professional Biomedical Studies	1.5	0	5
BIOM9010	Biomedical Engineering Practice	0	2	10
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
CHEN1020	Engineering 1 CE	6	6	30
MATH1131 MATH1141	Mathematics 1A or Higher Mathematics 1A	6	0	15
MATH1231 MATH1241	Mathematics 1B or Higher Mathematics 1B	0	6	15
PHPH1002	Physics 1002	6	6	30
Total HPW Session 1	**25.5**			
Total HPW Session 2	**26**			
Total Credit Points	**135**			

		HPW S1	HPW S2	CP
Year 2				
BIOM9420	Clinical Laboratory Science	3	0	15
CEIC2020	Computing	3	0	7.5
CHEN2010	Material and Energy Balance	2	2	10
CHEN2020	Flow of Fluids	4	0	10
CHEN2031	Heat and Mass Transfer	0	4	10
CHEN2050	Chem Eng. Practice 1	0	3	7.5
CHEN2060	Introd. to Process Chemistry	6	2	20
CHEN2070	Instrumental Analysis for Chemical Engineers	2	2	10
ELEC0809	Electrical Engineering 1C	2	0	6
MATH2031	Mathematics 2CH	2	3	20
MATH2899	Applied Statistics for Chemical Engineers	0	3	7.5
	General Education Subjects	0	4	15
Total HPW Session 1	**24**			
Total HPW Session 2	**23**			
Total Credit Points	**138.5**			

		HPW S1	HPW S2	CP
Year 3				
BIOM9311	Mass Transfer in Medicine	0	3	15
BIOT3100	Fermentation Processes	0	2	6
CHEN3011	Thermodynamics	3	0	9
CHEN3020	Process Modeling and Optimisation	0	3	9
CHEN3031	Advanced Transport Phenomena	0	3	9
CHEN3064	Process Design & Economics	3	3	18
CHEN3065	Plant and Equipment Design	2	2	12
CHEN3080	Chem Eng. Practice 2	2	1	9
CHEN3100	Kinetics and Chemical Reaction Engineering	2	2	12

		HPW S1	HPW S2	CP
CHEN3110	Systems Modeling & Analysis	2	0	7.5
PHPH2112	Physiology 1	6	6	30
General Education Subjects		2	0	7.5

Total HPW Session 1 22
Total HPW Session 2 25
Total Credit Points 144

Year 4

BIOM9332	Biocompatibility	0	3	15
BIOM9410	Regulatory Requirements of Biomedical Technology	0	3	15
BIOM5930	Research Project A	0	3	9
CHEN4031	Environ. Management 1	3	0	9
CHEN4130	Professional electives	0	3	9
CHEN4400	Social & Ethical Issues in Chemical Engineering	0	2	7.5
CHEN3071	Process Control	0	4	12
CHEN3041	Particle & Separation Processes	4	2	18
CHEN4081	Design Project	6	0	18
CIVL0616	Structures for Chem. Engin.	2	0	6
Biomedical Electives		3	0	15
General Education Subjects		2	0	7.5

Total HPW Session 1 20
Total HPW Session 2 20
Total Credit Points 141

Year 5

BIOM5391	Research Project B	9	0	27
BIOM9060	Biomedical Systems Analysis	3	0	15
BIOM9440	Biomedical Practical Measurement	0	3	15
BIOM9932	Research Project C	0	6	30
CHEN4120	Plant Operation & Business Management	3	3	18
	Biomedical Electives	3	3	30

Total HPW Session 1 18
Total HPW Session 2 15
Total Credit Points 135

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	4	20
BIOM9028	Radiation Physics	3	15
BIOM9321	Physiological Fluid Mechanics	4	15
BIOM9450	Clinical Information Systems	3	15
BIOM9621	Biological Signal Analysis	3	15
BIOM9701	Dynamics of the Cardio-vascular System	3	15
SAFE9224	Principles of Ergonomics	3	12
ANAT3131	Functional Anatomy 1	6	15
ANAT3141	Functional Anatomy 2	6	15
PATH9003	Principles of Disease Processes	3	12

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
BIOM9011	Professional Engineering Practice	1	2	15
CHEM1807	Chemistry 1ME	0	4	10
MANF1120	Intro to Manufacturing	0	5	10
MATH1131	Mathematics 1A or			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B or			
MATH1241	Higher Mathematics 1B	0	6	15
MATS9520	Eng. Materials	0	3	7.5
MECH1120	Design & Engineering Profession	3	0	7.5
MECH1300	Engineering Mechanics 1	4	0	10
MECH1400	Mechanics of Solids 1	0	3	7.5
MECH1500	Computing 1M	3	0	7.5
PHYS1918	Physics 1ME	6	0	15

Total HPW Session 1 23
Total HPW Session 2 23
Total Credit Points 120

Year 2

BIOM9420	Clinical Laboratory Science	3	0	15
ELEC0807	Electrical Engineering 1E	0	4	10
MATH2009	Engineering Mathematics 2	4	4	20
MATH2839	Statistics SM	3	0	7.5
MECH1130	Design Graphics	0	3	7.5
MECH2000	Preparation for Industrial Training			0.5
MECH2100	Machine Design	3	3	15
MECH2320	Engineering Mechanics 2	2	2	10
MECH2411	Mechanics of Solids 2A	3	0	7.5
MECH2412	Mechanics of Solids 2B	0	3	7.5
PHPH2112	Physiology 1	6	6	30

Total HPW Session 1 23
Total HPW Session 2 25
Total Credit Points 132.5

Year 3

ANAT2111	Introductory Anatomy	6	0	15
BIOM9332	Biocompatibility	0	3	15
MANF3400	Engineering Economics	2	0	5
MECH2600	Fluid Mechanics 1	2	2	10

		HPW S1	HPW S2	CP
MECH2700	Thermodynamics 1	2	2	10
MECH3000	Professional Ethics and Responsibility	0	2	5
MECH3100	Machine Systems Design	3	3	15
MECH3200	Engineering Experimentation	2	2	10
MECH3211	Linear Systems Analysis	3	0	7.5
MECH3212	Principles of Control of Mechanical Systems	0	3	7.5
MECH3300	Engineering Mechanics 3	0	2	5
MECH3310	Vibration Analysis	0	2	5
MECH3520	Programming & Numerical Methods or			
MECH3530	Computing Applications in Mechanical Systems	3	0	7.5
General Education subject/s		0	4	15

Total HPW Session 1 **23**
Total HPW Session 2 **25**
Total Credit Points **132.5**

Year 4

BIOM5000	Thesis A	0	6	15
BIOM9410	Regulatory Requirements of Biomedical Technology	0	3	15
BIOM9561	Mechanical Properties of Biomaterials	3	0	15
MECH3400	Mechanics of Solids 3	4	0	10
MECH3600	Fluid Mechanics 2	2	0	5
MECH3701	Thermodynamics 2	0	2	5
MECH3702	Heat Transfer	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
MANF4400	Engineering Management	2	0	5
MANF4412	Total Quality Management	0	2	5
Mechanical Engineering Technical Electives		9	3	30
Biomedical Electives		3	0	15

Total HPW Session 1 **23**
Total HPW Session 2 **22**
Total Credit Points **135**

Year 5

BIOM5000	Thesis A	6	0	15
BIOM9006	Thesis B	0	6	30
BIOM9440	Biomedical Practical Measurement	0	3	15
BIOM9541	Mechanics of the Human Body	3	0	15
Biomedical Electives		6	3	45

Total HPW Session 1 **15**
Total HPW Session 2 **12**
Total Credit Points **120**

Mechanical Engineering Technical Electives

Twelve session hours must be selected in Years 4 and 5. 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.

MECH4301	Plane Mechanism Kinematics	3 or 3		7.5
MECH4310	Advanced Vibration Analysis	3 or 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	3 or 3		7.5
MECH4410	Engineering Applications of Finite Elements	3 or 3		7.5
MECH4440	Theory of Plasticity	3 or 3		7.5

Design

MECH4120	Design Technology	3 or 3		7.5
MECH4131	Advanced CAD Modelling and Applications	3 or 3		7.5
MECH4150	Design and Maintenance of Components	3 or 3		7.5

Fluid and Thermal Engineering

MECH4610	Advanced Fluid Dynamics	3 or 3		7.5
MECH4690	Special Fluid Mechanics Elective	3 or 3		7.5
MECH4700	Internal Combustion Engine Processes	3 or 3		7.5
MECH4720	Solar Energy	3 or 3		7.5
MECH4730	Multiphase Flow	3 or 3		7.5
MECH4740	Thermal Power Plants	3 or 3		7.5
MECH4751	Refrigeration and Air Conditioning	3 or 3		7.5
MECH4790	Special Thermodynamics Elective	3 or 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	4	20
BIOM9028	Radiation Physics	3	15
BIOM9060	Biomedical Systems Analysis	3	15
BIOM9311	Mass Transfer in Medicine	4	15
BIOM9321	Physiological Fluid Mechanics	4	15
BIOM9450	Clinical Information Systems	3	15
BIOM9621	Biological Signal Analysis	3	15
BIOM9701	Dynamics of the Cardio-vascular System	3	15
SAFE9224	Principles of Ergonomics	3	15

ANAT3131	Functional Anatomy 1	6	15
ANAT3141	Functional Anatomy 2	6	15
SESC9551	Experimental Biomechanics	3	15

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.

Year 1		HPW S1	HPW S2	CP
BIOM1001	Professional Biomedical Studies	1.5	0	5
BIOM9010	Biomedical Engineering Practice	0	2	10
CHEM1807	Chemistry 1ME	0	4	10
COMP1011	Computing 1A	6	0	15
ELEC1011	Electrical Engineering 1	6	0	15
ELEC1041	Digital Circuits	0	3	9
MATH1131	Mathematics 1A	6	0	15
MATH1231	Mathematics 1B	0	6	15
MATH1090	Discrete Mathematics	0	3	7.5
PHYS1969	Physics 1	6	6	30

Total HPW Session 1 25.5
Total HPW Session 2 24
Total Credit Points 131.5

Year 2				
BIOM9410	Regulatory Requirements of Biomedical Technology	0	3	15
COMP1021	Computing 1B	6	0	15
ELEC2031	Circuit Theory	3	3	15
ELEC2015	Electromagnetic Applications	0	3	9
ELEC2033	Electronics 1	0	4	12
ELEC2041	Microprocessors & Interfacing	4	0	12
MATH2011	Several Variable Calculus	4	0	12
MATH2620	Higher Pure Maths 2 - Complex Analysis	0	2.5	7.5
MATH2849	Statistics EE	0	3	9
PHYS2949	Physics 2E (Electrical Engineering)	6	0	15
General Education subject/s		0	4	15

Total HPW Session 1 23
Total HPW Session 2 22.5
Total Credit Points 136.5

Year 3		HPW S1	HPW S2	CP
BIOM9430	Electromedical Standards	3	0	15
ELEC2042	Real Time Instrumentation	0	4	12
ELEC3004	Signal Processing 1	0	4	12
ELEC3005	Electrical Energy 1	4	0	12
TELE3013	Telecommunication Sys. 1	4	0	12
ELEC3014	Systems and Control 1	0	4	12
ELEC3017	Electrical Engineering Design	0	5	12.5
MATH2501	Linear Algebra	5	0	12.5
MATH3150	Transform Methods	2	0	7.5
PHPH2112	Physiology 1	6	6	30

Total HPW Session 1 24
Total HPW Session 2 23
Total Credit Points 137.5

Year 4				
BIOM9420	Clinical Laboratory Science	3	0	15
BIOM5910	Thesis Part A	0	6	15
ELEC3006	Electronics 2	5	0	12.5
ELEC3041	Real Time Engineering	4	0	12
ELEC4010	Introduction to Management for Electrical Engineers	4	0	12
ELEC4011	Ethics and Electrical Engineering Practice	0	2	7.5
ELEC4483	Biomedical, Instrumentation, Measurement and Design	0	4	12
ELEC4903	Industrial Training	0	0	0
MATH3141	Numerical and Mathematical Methods	0	4	12
General Education subject/s		2	2	15
Biomedical Electives		0	3	15
Electrical Electives		4	0	12

Total HPW Session 1 22
Total HPW Session 2 21
Total Credit Points 140

Year 5				
BIOM5911	Thesis Part B	12	0	30
BIOM9812	Thesis Part C	0	9	45
BIOM9410	Regulatory Requirements of Biomedical Technology	0	3	15
BIOM9440	Biomedical Practical Measurement	0	3	15
Biomedical Electives		3	3	30

Total HPW Session 1 15
Total HPW Session 2 18
Total Credit Points 135

Biomedical Engineering Electives			
BIOM9027	Medical Imaging	4	20
BIOM9028	Radiation Physics	3	15
BIOM9060	Biomedical Systems Analys.	3	15
BIOM9311	Mass Transfer in Medicine	3	15
BIOM9332	Biocompatibility	3	15
BIOM9450	Clinical Information Systems	3	15
BIOM9510	Introductory Biomechanics	3	15
BIOM9701	Dynamics of the Cardiovascular System	3	15

		HPW S1	HPW S2	CP
Electrical Engineering Technical Electives				
ELEC4351	Data Communication and Computer Networks	4		12
ELEC9342	Signal Processing 2: Advanced Techniques	3		12
ELEC9370	Digital Image Processing Systems	3		12
ELEC9405	Human Movement Control Systems	3		12
ELEC9407	Cybernetic Engineering	3		12
ELEC9412	Biological Signal Analysis	3		12
ELEC9416	Non-linear Systems and Simulation	3		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
√	BIOM1001	Professional Biomedical Studies	1.5	0	5
√	BIOM9010	Biomedical Engineering Practice	0	2	10
√	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
√	MATH1090	Discrete Mathematics	6	0	15
√	PHYS1969	Physics 1	6	6	30
	Total HPW Session 1	**25.5**			
	Total HPW Session 2	**26**			
	Total Credit Points	**135**			

	Year 2				
	BIOM9028	Radiation Physics	0	3	15
	BIOM9060	Biomedical System Analysis	3	0	15
	COMP2011	Data Organisation	5	0	15
	COMP2021	Digital System Structures	5	0	15
	COMP2221	Microprocessors & Interfacing	0	5	15
	ELEC2031	Circuits and Systems	3	3	15
	ELEC2033	Electronics 1	0	4	12
	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
	General Education Elective(s)		2	0	7.5
	Total HPW Session 1	**20.5**			
	Total HPW Session 2	**20.5**			
	Total Credit Points	**133.5**			

	Year 3				
	ANAT2111	Introductory Anatomy	6	0	15
	BIOM9027	Medical Imaging	0	4	20
	BIOM9410	Regulatory Requirements of Biomedical Technology	0	3	15
	COMPxxxx	Software Project Management	2.5	0	7.5
	COMP0001	Total Quality Management	0	2.5	7.5
	COMP3231	Operating Systems	5	0	15
	TELE3013	Telecommunication System 1	4	0	12
	MATH3150	Transform Methods	0	2	7.5
	General Education Elective(s)		2	4	22.5
	Computing Electives		0	5	15
	Total HPW Session 1	**19.5**			
	Total HPW Session 2	**20.5**			
	Total Credit Points	**137**			

	Year 4				
	BIOM5920	Thesis A	0	7	17.5
	COMP3111	Software Engineering	0	5	15
	COMP4903	Industrial Training	0	0	
	COMP9416	Knowledge-Based Systems	3	0	15
	IROB2720	Managing People	2	0	7.5
	SENG4920	Professional Issues & Ethics	0	2.5	7.5
	PHPH2112	Physiology 1	6	6	30
	Biomedical Electives		0	3	15
	Computing Electives		10	0	30
	Total HPW Session 1	**21**			
	Total HPW Session 2	**23.5**			
	Total Credit Points	**137.5**			

	Year 5				
	BIOM5921	Thesis B	14	0	35
	BIOM9440	Biomedical Practical Measurment	0	3	15
	BIOM9922	Masters Thesis	0	6	30
	COMP9517	Image Processing and Applications	0	3	15
	Biomedical Electives		0	3	15
	Total HPW Session 1	**17**			
	Total HPW Session 2	**18**			
	Total Credit Points	**140**			

	Biomedical Engineering Electives			
	BIOM9060	Biomedical Systems Analysis	3	15
	BIOM9311	Mass Transfer in Medicine	3	15
	BIOM9321	Physiological Fluid Mechanics	3	15
	BIOM9332	Biocompatibility	3	15
	BIOM9420	Clinical Laboratory Science	3	15
	BIOM9450	Clinical Information Systems	3	15

BIOM9510	Introductory Biomechanics	3	15
BIOM9603	Image and Flow Cytometry	3	15
BIOM9621	Biological Signal Analysis	3	15
BIOM9701	Dynamics of the Cardiovascular System	3	15

Computer Engineering Electives

COMP4211	Advanced Architecture and Design	4	12
COMP4411	Artificial Intelligence: Knowledge-Based Systems	4	12
COMP4444	Neural Networks	4	12
ELEC4042	Signal Processing	4	12
ELEC9370	Digital Image Processing Syst.	3	15
ELEC9405	Human Movement Control Systems	3	15
ELEC9416	Non-linear Systems and Simulation	3	15
TELE3013	Telecommunications Systems 1	4	12
ELEC3016	Electronics 3	4	12
MATH2501	Linear Algebra or		
MATH2601	Higher Linear Algebra	5	15

Postgraduate 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 totaling 240 credit points, 180 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 60.

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 90 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)	HR	30
Strand B Subjects, Medical/Life Sciences Candidates			
BIOM9040	Analogue Electronics for Biomedical Engineers		15
BIOM9101	Mathematical Modelling for Biomedical Engineers		20
BIOM9501	Computing for Biomedical Engineers		15
BIOM9050	Microprocessors and Circuit Design for Biomedical Engineers		15
General Subjects			
BIOM9060	Biomedical Systems Analysis		15
BIOM9510	Introductory Biomechanics	(1)	15
BIOM9551	Biomechanics of Physical Rehabilitation		15
BIOM9601	Biomedical Applications of Microcomputers 1		15
BIOM9621	Biological Signal Analysis		15
BIOM9701	Dynamics of the Cardiovascular System		15
ELEC9411	Introductory Physiology for Engineers	P	15
Session 2			
General Subjects			
BIOM9010	Biomedical Engineering Practice		10
BIOM9012	Biomedical Statistics		20
BIOM9018	Project Report	C	90
BIOM9027	Medical Imaging		20
BIOM9028	Radiation Physics		15
BIOM9311	Mass Transfer in Medicine		15
BIOM9321	Physiological Fluid Mechanics		15
BIOM9332	Biocompatibility		15
BIOM9541	Mechanics of the Human Body		15
BIOM9561	Mechanical Properties of Biomaterials		15
BIOM9602	Biomedical Applications of Microcomputers 2		15
BIOM9612	Medical Instrumentation		15

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 an optional 30 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. 60 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.

		Notes	CP
Session 1			
BIOM9060	Biomedical Systems Analysis		15
BIOM9510	Introductory Biomechanics	(1)	15
BIOM9551	Biomechanics of Physical Rehabilitation	(2)	15
BIOM9601	Biomedical Applications of Microcomputers 1	(3)	15
BIOM9621	Biological Signal Analysis		15
BIOM9701	Dynamics of the Cardio-vascular System		15
ELEC9411	Introductory Physiology for Engineers	(4)	15
Session 2			
BIOM9010	Biomedical Engineering Practice	(4)	10
BIOM9012	Biomedical Statistics		20
BIOM9027	Medical Imaging	(5)	20
BIOM9028	Radiation Physics		15
BIOM9311	Mass Transfer in Medicine		15
BIOM9321	Physiological Fluid Mechanics		15
BIOM9332	Biocompatibility		15
BIOM9541	Mechanics of the Human Body	(2)	15
BIOM9561	Mechanical Properties of Biomaterials	(2)	15
BIOM9602	Biomedical Applications of Microcomputers II	(6)	15
BIOM9603	Image and Flow Cytometry		15
BIOM9612	Medical Instrumentation		15
BIOM9913	Project Report	(7)	30

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.

5445
Graduate Diploma in Biomedical Engineering

GradDip

Details of the recommended programs of study, totalling at least 90 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 and Telecommunications 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 ÎHandbook Guidel, appearing earlier in this book.

BIOM1001
Professional Biomedical Studies
Staff Contact: Prof K Schindhelm
CP5 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: School Office
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 Part A
Staff Contact: School Office
CP15 S2 HPW6
For BE(Elec)/MBiomedE students only.

BIOM5911
Thesis Part B
Staff Contact: School Office
CP30 S1 HPW12
For BE(Elec)/MBiomedE students only.

BIOM9006
Thesis B
Staff Contact: School Office
CP30 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
CP10 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
CP20 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: School Office
CP90
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 CD Bertram
CP20 S2 L2 T2
Prerequisites: Assumed knowledge/prerequisites BIOM9028

Fundamentals of producing a medical image, image collection techniques, image reconstruction algorithms. Detailed examination of the 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 BK Milthorpe
CP15 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 N Lovell
CP10 S1 L2 T1
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 BK Milthorpe
CP15 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
CP15 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
CP20 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
CP15 S2 L2 T1

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 CD Bertram
CP15 S2 L2 T1

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
CP15 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
CP15 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 BK Milthorpe
CP15 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: A/Prof AP Avolio
CP15 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
CP15 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
CP15 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: Dr N Lovell
CP15 S1 L1 T3
Note/s: Highly recommended for Strand B students. This subject is for students with little or no previous computing experience or for those students who wish to learn about object oriented programming in a Windows environment.

Algorithm design and documentation; programming in standard PASCAL and in Delphi for Windows; object oriented program design; event driven programming in a graphical environment; database structures and interfacing.

BIOM9510
Introductory Biomechanics
Staff Contact: School Office
CP15 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
CP15 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
CP15 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 BK Milthorpe
CP15 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: A/Prof A Avolio
CP15 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 coprocessor; 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: A/Prof A Avolio
CP15 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 BK Milthorpe
CP15 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 CD Bertram
CP15 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 CD Bertram
CP15 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 CD Bertram
CP15 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: School Office
CP45 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.

BIOM9913
Project Report
CP30
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 Programs in Business and Technology

Director
Dr John Toohey
Adjunct Professor, Faculty of Engineering

Deputy Director and Business Manager

Mr Michael McGuirk
Adjunct Associate Professor, Faculty of Engineering

Graduate Programs in Business and Technology (GPBT) is a joint initiative between the Faculty of Engineering and the Faculty of Commerce and Economics. It is administratively located within the Faculty of Engineering.

GPBT currently offers the Master of Business and Technology (MBT) with the Graduate Diploma in Industrial Management (GradDipIndMgmt); the Master of Technology Management (MTM) and the Master of Commerce (Open Learning) (MCom). A non-award Industrial Management Qualification (IMQ) is also offered and planning is underway to change this into an award status Graduate Certificate in Industrial Management. The Faculty of Engineering is the Course Authority for the MBT, GradDipIndMgmt and MTM.

The MBT and GradDipIndMgmt are business degrees with a technological orientation. The MTM is a technology degree with a management orientation. The MTM is designed for both the recent graduate and for students who have some years experience in industry and wish to build upon their initial education to progress their career.

MBT Program

The MBT is a business program with a technological orientation. Courses in the MBT Program aim at providing professional engineers, other technical and non-technical people with world-class business education and training. The MBT Program was developed with the support of industry and the program continues a commitment to quality and relevance in tertiary education to the private and public sectors.

The program provides opportunities for students to develop the skills, knowledge and attitudes necessary to meet the challenges of the business world. Individual subjects are designed around core management demands and blend mainstream business requirements with the challenges of evolving technologies.

Courses in the MBT Program can be taken by distance mode, on campus or through a combination of both. This flexible delivery assists with the demands of modern work organisation and family commitments. All of the materials necessary for the completion of the program are supplied in comprehensive individual subject manuals. Some subjects are accessible in electronic formats and all subjects are supported by quality academic staff who are available for personal consultation.

Assessment, as far as possible, is centred on the day to day work of students and around their education and training needs of that of their organisations. UNSW academic staff are supported by external industry experts in the delivery of subjects including interaction and consultation with students.

Candidates successfully completing four MBT subjects will have the option of either being awarded an Industrial Management Qualification (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 Faculty 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.

In order to fulfil the requirements 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

To qualify for the Master of Business and Technology (MBT), a candidate must successfully complete a minimum of 180 credit points (normally 12 subjects of 15 credit points each). However candidates admitted to the MBT with an approved degree need only complete a minimum of 150 credit points (normally 10 subjects of 15 credit points each). The course can normally be completed in five sessions. The minimum time for completion is two sessions on a full time basis, however, the course must be completed within a maximum of ten sessions. In exceptional circumstances and with approval of the Faculty of Engineering, a candidate may undertake a project equivalent to 30, 45, or 60 credit points and the balance may be taken from the following subjects:

Subjects		CP
ACCT5901	Accounting: A Users Perspective	15
ACCT5981	Strategic Resource Management	15
ACCT5983	Managing Strategic Change	15
ACCT5985	The Innovative Organisation	15
AVIA5001	Law and Regulation in Aviation	15
AVIA5002	Aviation Operations Management	15
AVIA5003	Aviation and Security	15
AVIA5004	Aviation Safety and Accident Prevention	15
BIOT7201	Food Biotechnology (Principles)	15
BIOT7220	Food Biotechnology (Application)	15
BIOT7320	Food Biotechnology (Management)	15
GBAT9101	Project Management	15
GBAT9102	Management of Manufacturing Systems	30
GBAT9103	Environmental Management	15
GBAT9104	Management of Innovation and Technical Change	15
GBAT9105	Risk Management	15
GBAT9106	Information Systems Management	15
GBAT9107	Maintenance Management	15
GBAT9109	Energy Management	15
GBAT9110	Management of Human Resources	15
GBAT9111	Organisation for Total Quality Improvement	15
GBAT9112	Managing Occupational Health and Safety	15
GBAT9113	Strategic Management of Business and Technology	15
GSOE9114	Marketing for Technical Managers	15
GSOE9115	Information Technology for Managers	15

or other subjects as may be approved by the Faculty.

Courses of study leading to the award of a Master of Business and Technology provide candidates 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 15 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.

5457
Graduate Diploma in Industrial Management GradDipIndMgmt

Candidates must complete a minimum program totalling 120 credit points taken from MBT subjects or such other subjects as may be approved by the Faculty. Those successfully completing all 120 credit points may elect to graduate with the Graduate Diploma in Industrial Management or if they wish to proceed to the Masters. For further information, contact the Director, Graduate Programs in Business and Technology.

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 MBT and the GradDipIndMgmt are full-fee paying and may be undertaken by distance learning or by face to face learning.

Subject Descriptions

Descriptions of all subject 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.

ACCT5901
Accounting: A User Perspective
Coordinator: *Prof Ken Trotman*
CP15

This subject is primarily for the users rather than the preparers of accounting information. The focus is on the understanding and the use of accounting information, as well as the composition and meaning of the financial

statements prepared for resource providers in accordance with the law and contractual arrangements and accounting systems and reports designed for the decision-makers within an organisation.

ACCT5981
Strategic Resource Management
Coordinator: Mr Rodney Coyte
CP15

Focuses on the ways in which organisations utilise available resources to generate value over time. Attention is given to the drivers of both shareholder and customer value as guides to organisational performance in capital and product/service markets respectively. The transformation of resources in and out of financial forms is at issue, as is the elimination of waste in the process. The key question is: How does resource deployment support strategy effectively in the midst of continuous change?

ACCT5983
Managing Strategic Change
Coordinator: Prof Sid Gray
CP15

Offers a perspective from the cutting edge of international strategic theory and practice. Topics include: alternative strategic frameworks; the development of competitive strategies; strategic thinking; the techniques of strategic analysis (including the performance audit; environmental and values analysis); organisational culture and strategy implementation; and the paradigm shift from competition to collaboration.

ACCT5985
The Innovative Organisation
Coordinator: Ms Tracy Wilcox
CP15

Introduces you to current thinking on how new organisational structures and processes can support superior organisation performance. Topics include: the new organisational agenda; from mass production to lean production; the world best practice organisation; new work structures; skills formation; performance measurement; enterprise bargaining; networks and the learning organisation.

AVIA5001
Law and Regulation in Aviation
Coordinator: Mr Ronald Bartsch
CP15

This subject provides you with an overview of the regulatory structure of civil aviation in Australia. It focuses on the legal system within which this regulatory system operates and the powers, responsibilities and scope of the various aviation regulatory authorities. In particular the subject will concentrate on providing a practical insight into the legal implications associated with various aviation personnel and of the pilot-in-command.

AVIA5002
Aviation Operations Management
Coordinator: Mr Rodger Robertson
CP15

This subject provides you with an appreciation of the aviation industry's main drivers, the short term planning processes and their relationship to the day to day operational decisions made within airline operations. Aviation industries structure both past and present are examined, future directions projected as is the relationship of the industry to the providers of infrastructure.

AVIA5003
Aviation and Security
Coordinator: Mr Ron Armstrong
CP15

Aviation Security needs to be a co-partner with all those involved in the operational requirements of civil aviation. Past disasters have provided appalling lessons that any departure from strict, internationally accepted procedures, creates a void for those intent on acts of unlawful interference.

The subject deals with the broad issue of security within the aviation arena. With objectives that include the provision of: a security appreciation for professionals and managers, a perspective of the human and organisational dimensions of aviation security, an explicit understanding of responsibilities, the mechanism of implementation and the ability to determine and report on security events, This subject is designed for a wide cross section of professionals in the aviation, transport and affiliated industries.

AVIA5004
Aviation Safety and Accident Prevention
Coordinator: Mr Ronald Bartsch
CP15

Safety and Accident prevention is an issue in almost every week of life; none more than so within the Aviation Industry. The objective of this subject is to provide those working in aviation and associated industries with a broad and detailed understanding of the commercial aviation safety systems and strategies with a broad and detailed understanding of the commercial aviation safety systems and strategies developed to make that system safer. While the subject specifically relates to commercial air service operations in Australia it is also recognises the vital importance of global cooperation and the role of specific international organisations. Also focusing on the investigation and prevention of accidents, the roles of the Bureau of Air Safety and the Aviation Regulatory authorities are examined.

GBAT7210
Food Biotechnology (Principles)
Coordinator: Prof Peter Rogers
CP15

The subject covers the basic principles in food biotechnology including techniques of genetic manipulation of micro-organisms, pronciples of cell culture, bioreactor design, operation and control for the food industry, the use of bacteria in the production of new and novel foods, the

use of yeast and fungi in foods, and the principles involved in developing probiotics and functional foods. Examples are taken from the food industry where the pronciples of food microbiology and bioprocess engineering are both essential to an understanding of food processes and innovation. A basic knowledge of cell biology and biochemistry is assumed.

GBAT7220
Food Biotechnology (Applications)
Coordinator: Prof Peter Rogers
CP15

The subject reviews a range of applications in the food industry where biotechnology principles are involved. These include: the application of the principles of biocontrol in food production and the extension of shelf life, the application of enzymes in food production, the use of molecular diagnostic and analytical procedures for food monitoring, new technologies in the treatment and utilisation of food processing wastes, the applications of both plant and animal biotechnology for enhanced food production and implications of transgenic plants and animals. A basic knowledge of cell biology and biochemistry is assumed.

GBAT7230
Food Biotechnology (Management)
Coordinator: Prof Peter Rogers
CP15

The subject is designed to develop management skills related to biotechnology-based innovations in the food industry. It provides an overview and analysis of the Australian and international food industries as well as covering the principles of economic feasibility analysis for new opportunities and sratategies for effective R&D, marketing and commercialization to exploit these opportunities. Intellectual property and patenting regulatory aspects (novel foods, applications of gene technology in foods) are also covered as well as a comparative study of food standards in Australia and internationally. A series of case studies on new food biotechnology products and processes is designed to integrate the various concepts developed in the course.

GBAT9101
Project Management
Coordinator: Prof David Carmichael
CP15

Project Management involves the overall planning, control and coordination 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.

GBAT9102
Management of Manufacturing Systems
Coordinator: A/Prof Roger Kerr
CP30

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.

GBAT9103
Environmental Management
Coordinator: A/Prof Ronnie Harding
CP15

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.

GBAT9104
Management of Innovation and Technical Change
Coordinator: Adjunct Prof Daryll Hull
CP15

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.

GBAT9105
Risk Management
Coordinator: Prof Jean Cross
CP15

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.

GBAT9106
Information Systems Management
Coordinator: Mr Geoffrey Dick
CP15

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).

GBAT9107
Maintenance Management
Coordinator: Dr Robin Platfoot
CP15

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.

GBAT9109
Energy Management
Coordinator: Dr Geoffrey Sergeant
CP15

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.

GBAT9110
Management of Human Resources
Coordinator: Prof David Carmichael
CP15

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.

GBAT9111
Organisation for Quality Improvement
Coordinator: Dr Peter Gibson
CP15

Examines the central role that a commitment to quality can play in improving the productivity and competitive position of an organisation. The key issues and techniques of quality management, and the skills needed to implement and consolidate TQM improvements, are investigated.

GBAT9112
Managing Occupational Health and Safety
Coordinator: Adjunct Prof John Toohey
CP15

Workplace injury involves organisations in insurable costs (workers' compensation premium) and uninsurable costs (fines, 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. The health and safety laws of various jurisdictions are analysed and industry case studies are used to illustrate the application of prevention and management strategies.

GBAT9113
Strategic Management of Business and Technology
Coordinator: Dr Peter Gibson
CP15

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.

GBAT9114
Marketing for Technical Managers
Coordinator: Dr Chris Dubelaar
CP15

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.

GBAT9115
Information Technology for Managers
Coordinator: Mr Geoffrey Dick
CP15
Prerequisite: Students must have personal access to a PC.

This subject has the principle objective of giving line managers an understanding of how information technology might be able to assist them in their day to day tasks and the capabilities and drawbacks of that technology, including changes to the workplace. In addition the subject will ensure that knowledge/information workers take away a range of essential skills including use of computers, decision support tools, database query languages, presentation tasks and tools and an understanding of the Internet covering some of the opportunities and problems it presents.

8007
Master of Technology Management
MTM

The Master of Technology Management degree is a new multidisciplinary course approved by the UNSW Council in June 1996. The four faculties who participate in this unique joint enterprise are the Faculties of Science and Technology, Life Sciences, 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.

The major strength of the course is its flexibility. It is designed not only for the recent graduate but also for students who have some years experience in industry and have discovered the areas where their initial education needs strengthening to progress their career. This course provides a mechanism for such people to select from a broad range of subjects and choose those that are most suited to their own industry and their own career path.

A candidate for the MTM degree should have either a four year bachelor's degree or a three year degree plus either another qualification at an acceptable level, or other academic or professional attainments (including relevant work experience). An applicant who submits evidence of such other academic and professional qualifications as may be approved by the MTM Course Committee may be permitted to enrol in the degree.

Subjects in the MTM course are in four categories and the overall course is structured around the maximum and minimum numbers of subjects that can be drawn from each. The range of choice within the categories is wide and, within the overall structure, students are provided with the opportunity to construct a course best suited to their background and professional needs.

Candidates are required to complete 120 credit points, gained through approved subjects. These subjects will be standardised, as far as possible, at 15 credit points per subject, or fractions thereof.

The subjects will be grouped into 4 categories:

Category A:	a minimum of 30 and a maximum of 45 credit points (normally a minimum of 2 and a maximum of 3 subjects)
Category B:	a minimum of 30 and a maximum of 45 credit points (normally a minimum of 2 and a maximum of 3 subjects)
Category C: & D together	a minimum of 30 and a maximum of 60 credit points (normally a minimum of 2 and a maximum of 4 subjects)

Before enrolment an applicant should submit an intended program for approval to ensure that the program is suitably focussed, and the applicant's academic background is adequate for all chosen subjects.

The maximum period of enrolment is 2 academic sessions for a full time candidate and 4 academic sessions for a part time candidate.

The Master of Technology Management is a full fee paying course. There are differences in the fee schedules for permanent residents and citizens of Australia and for international students. These fees are set annually.

Category A: Commercial and Business Studies

The MTM course provides for a minimum of 30 and a maximum of 45 credit points (normally a minimum of 2 and a maximum of 3 subjects) from this group.

Most of these subjects are designed to provide the knowledge and skills to deal with the major issues facing modern management. Prerequisites and special conditions may apply to these subjects depending on the prior knowledge of the student. It is the responsibility of the student to satisfy these conditions or to negotiate exemptions. Subjects are available in the following disciplinary streams.

Accounting and Financial Management

ACCT5901	Accounting: A User Perspective
ACCT5915	Individual Judgement and Choice
ACCT5931	Strategic Management Accounting
ACCT5932	Public Sector Accounting and Financial Reporting
ACCT5956	Management Planning and Control
CIVL8701	Engineering Economics and Financial Management
CIVL8714	Resource Management
FINS5511	Corporate Finance
FINS5512	Financial Markets and Institutions
FINS5513	Security Valuation and Portfolio Selection

Economics

ECON5103	Business Economics
ECON5248	Business Forecasting

Industrial Relations

IROB5701	Australian Industrial Relations
IROB5711	Employment and Industrial Law
IROB5712	Negotiations, Bargaining and Advocacy

Organisational Management

ACCT5917	Strategic Management: Systems and Processes
ACCT5949	Managerial Dynamics
IROB5900	Social and Organisational Analysis
IROB5901	Organisational Behaviour
IROB5903	Organisational Innovation and Change
IROB5904	Corporate, Management and Union Strategy
IROB5912	International Dimensions of Negotiation Behaviour
IROB5914	Employee Communications
IR0B5915	Human Potentialities
IROB5920	Men and Women in Organisations
IROB5947	Remuneration and Performance Management
SESC9300	Effective Behaviour in Organisations

Human Resource Management

CIVL8706	Human Resources Management
IROB5906	Human Resource Management in Context
IROB5908	Strategic Human Resource Management
IROB5948	Human Resource Recruitment, Selection and Development

Information Systems

INFS5957	Information and Decision Technology
INFS5989	Information Systems Design
INFS5988	Business Information Systems
INFS5991	Decision Support Systems

Legal Studies

CIVL8707	Contracts Management
CIVL8726	Legal Studies and Professional Practice
LEGT5511	Legal Foundations of Business
LEGT5531	Legal Regulations for Business
LEGT5541	Company Law
LEGT5551	Revenue Law
LEGT5561	Legal Aspects of Finance
LEGT5562	Business Law in a Global Economy
LEGT5571	Franchising
SESC9020	Occupational Health and Safety Law 1
SESC9030	Occupational Health and Safety Law 2
SESC9273	Environment and Law

Marketing

MARK5902	Elements of Marketing
MARK5903	International Marketing

Category B: Technology Management

The MTM course provides for a minimum of 30 and a maximum of 45 credit points (normally a minimum of 2 and a maximum of 3 subjects) from this group.

The subjects deal with the application of management concepts in specific technical settings.This group is particularly designed to provide students with the opportunity to learn new tools and new ways of dealing with management and technology issues in modern business and industry organisations.

Environmental Technologies

CIVL9872	Solid Waste Management
CIVL9881	Hazardous Waste Management
CIVL8872	Solid Waste Management
CIVL8881	Hazardous Waste Management
FUEL5880	Unit Operations in Wastewater Sludge, and Solids Management
GEOG9042	Environmental Impact Assessment
GEOG9150	Remote Sensing Applications
GEOG9240	Principles of Geographic Information Systems
GEOG9290	Image Analysis of Remote Sensing
GEOG9300	Vegetation Management
GEOG9320	Soil Degradation and Conservation
SESC9711	Environmental Planning and Assessment
SESC9741	Environmental Management Systems

Information Technologies

COMP9008	Software Engineering
GEOG9210	Computer Mapping and Display
GEOG9280	Application and Management of Geographical Information Systems
GEOG9242	Transportation Applications of Geographical Information Systems
INFS5848	Information Systems Project Management
INFS5928	Software Engineering Management
INFS5953	Information Systems Management
INFS5983	Business Data Communications
INFS5992	Data Management

Project Management

BIOM9410	Regulatory Requirements of Biomedical Technology
CIVL8731	Project Management Framework
CIVL8702	Project Planning and Control
CIVL8703	Quality and Quality Systems
MANF9400	Industrial Management
MANF9410	Total Quality Management
MANF9470	Production Management 1
MANF9601	Economic Decisions in Industrial Management

Mining and Extractive Technologies

KCME4203	Mine Management
KCME4204	Mineral Exploration Project Management

Safety Management

SESC9091	Safety, Health and Environmental Practice
SESC9170	Traffic Safety
SESC9310	Issues in Safety Management
SESC9350	Personal Protective Equipment
SESC9600	Introduction to Occupational Health
SESC9850	Management of Dangerous Materials

Risk Management

SESC9211	Risk Management
SESC9231	Risk Analysis
CIVL8710	Management of Risk

Category C: Broad Technology

The MTM course provides for a minimum of 30 and a maximum of 60 credit points (normally a minimum of 2 and a maximum of 4 subjects) from this group and group D.

The broad technology subjects are intended to provide the graduate engineer or technologist with an introduction to a subject area that students may not have studied in the undergraduate course but which has now become professionally important or whose technological basis has only recently developed.

Biomedical Engineering

BIOM9027	Medical Imaging
BIOM9028	Radiation Physics

BIOM9060	Biomedical Systems Analysis
BIOM9321	Physiological Fluid Mechanics
BIOM9332	Biocompatibility
BIOM9430	Electromedical Standards
BIOM9510	Introductory Biomechanics
BIOM9541	Mechanics of the Human Body
BIOM9621	Biological Signal Analysis
BIOM9701	Dynamics of the Cardiovascular System

Biotechnology

BIOT7081	Environmental Biotechnology
BIOT7110	Bioengineering Principles
BIOT7051	Applied Genetics
BIOT7061	Peptide and Protein Technology
BIOT7071	Biochemical Engineering
BIOT7081	Environmental Biotechnology

Chemical Engineering and Industrial Chemistry

CEIC5342	Energy Management in the Process Industries
CEIC5340	Polymer Synthesis: Fundamentals and Techniques
CEIC5330	Process Engineering and the Petroleum Industry
CEIC5336	Environmental Chemistry in the Process Industries
CEIC5337	Particle Characterisation in the Process Industries

Fibre Science and Technology

TEXT5601	Colour Science

Food Science and Technology

FOOD3517	Nutrition

Geography

GEOG9150	Remote Sensing Applications
GEOG9230	Population, Health and Environment

Geology

GEOL9010	Groundwater Environments
GEOL9060	Environmental Geology

Materials Science and Engineering

IDES5051	Plastics, Materials and Processes

Mining Engineering

MINE0130	Principles of Mining

Safety Science

SESC9511	Occupational Hygiene
SESC9631	Occupational Medicine
SESC9721	Environment and Medicine
SESC9200	Hazard and Risk Assessment
SESC9421	Applied Ergonomics
SESC9441	Ergonomics and New Technology

Category D: Specialist Subjects

The MTM course provides for a minimum of 30 and a maximum of 60 credit points (normally a minimum of 2 and a maximum of 4 subjects) from this group and group C.

This group contains the specialist technical subjects which make up the postgraduate coursework programs in the Faculties of Engineering, Science and Technology, and Life Sciences. They are advanced treatments of the subject matter that go beyond the content or level of the usual undergraduate course. Many of the graduate subjects from the Faculties of Engineering, Science and Technology, and Life Sciences are available to MTM students, a great number of them in highly technical and specialised areas. Further information on these subjects may be obtained from the Graduate Programs in Business and Technology.

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 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.

Centre for Advanced Numerical Computation in Engineering and Science
Centre for Applied Polymer Science
Centre for Particle and Catalyst Technologies
Photovoltaics Special Research Centre
Centre for Postgraduate Studies in Civil and Environmental Engineering
Centre for Remote Sensing and Geographic Information Systems
Centre for Water and Waste Technology
Energy Research, Development and Information Centre (ERDIC)
Graduate Programs in Business and Technology
Munro Centre for Civil and Environmental Engineering
UNESCO Centre for Membrane Science and Technology
UNSW Groundwater Centre

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

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

Faculty Centres

Centre for Advanced Numerical Computation in Engineering and Science

Director:
Professor CAJ Fletcher

Administrative Offier
Ms Karen Hahn

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 and Technology 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 in the Faculty of Science and Technology. Further information on course structure and subject descriptions can be found in the Faculty of Science and Technology 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 ëHandbook Guideí, appearing earlier in this book.

ANCE8001
Computational Mathematics
Staff Contact: CANCES
CP12 S1 HPW3

Discretisation, linear algebra, ODE and PDE solvers, appropriate for contemporary computational engineering 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 parameterisation; 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.

MATH5315
High Performance Numerical Computing
Staff Contact: Mathematics
CP12 SS HPW3

Techniques and tools used for efficient accurate solution of large scale numerical problems on modern high performance computers.

Centre for Applied Polymer Science

Director:
Professor R Burford

The Centre for Applied Polymer Science has been established to encourage collaboration between groups which have significant activities in polymer science and engineering. The multidisciplinary nature of Polymer Science is reflected by the fact that members of the Centre have interests spanning biomaterials, textiles, packaging and industrial manufacture of resins. A priority in the establishment of this Centre therefore, is to bring together appropriate expertise to tackle multifaceted problems, rather than focus upon a single discipline.

The University is well equipped with major items of equipment for the study of polymer structures and morphology. High resolution surface analysers, electron microscopes, thermal analysers and other sophisticated facilities are able to be accessed by members of the Centre.

Centre for Minerals Engineering

Co-Directors:
Dr AC Partridge
Dr T Tran

The Centre for Minerals Engineering (CME) coordinates and conducts teaching and research activities of relevance and concern to the minerals industry. The Centre is jointly run by the School of Chemical Engineering and Industrial Chemistry, the School of Mines and the School of Materials Science and Engineering.

Since the Centre started in 1991, it has established close links with industry and other research institutions. In 1992, the Centre commenced research in areas related to alumina and metallurgical waste processing.

Major research areas include processing of precious metals, treatment of mineral processing wastes, fundamental aspects of flotation, permeability, shear strength and particle segregation in stock-piles, coal preparation including effects of mining methods, numerical computational modelling of mineral slurry systems, distributors, and spiral concentrators. Staff associated with the Centre participate in various training programs overseas and have organised workshops and short courses in collaboration with the Key Centre for Mines.

The Minerals Engineering elective is offered to students in Course 3040 who wish to obtain a basic training in preparation for a career in the mineral industry. Students wishing to specialise in Minerals Engineering enrol in the BE course in Chemical Engineering in Years 1 and 2, and undertake studies in Minerals Engineering in Years 3 and 4 as professional electives in this degree. For details of subjects offered see the course outline for Course 3040 in the undergraduate section for the School of Chemical Engineering and Industrial Chemistry in this handbook.

Centre for Particle and Catalyst Technologies

Director:
Dr R Amal

The Centre for Particle and Catalyst Technologies is located within the School of Chemical Engineering and Industrial Chemistry. It was established to encourage research in particulate systems and heterogenous catalysis undertaken within the University, and to promote unique University facilities as services available to industry and government bodies.

Special objectives of the Centre include promotion of testing facilities available within the University. A wide range of industries, including pharmaceutical, chemical, water, etc. industries have sent samples for particle characterisation over the last two years. This has been achieved in conjunction with Unisearch (UNSWís corporate research arm), by the establishment of a centralised organisation for the allocation, review and management of short-term consultancy projects in particle and catalyst characterisation.

In addition to short-term projects, the Centre has been successful in attracting long-term industrial research contracts and research grants, resulting in improved transfer of technology to Australian industry in the areas of catalyst development, instrumental methods for particle and catalyst characterisation, and particulate systems.

The Centre also plays an important role in offering continuing education courses and conferences in areas relevant to industry.

The Centre houses much state-of-the-art equipment. These instruments allow staff and students to characterise particulate material in terms of size, surface area and other physical and chemical properties. The characteristics of particulate material influences its behaviour both as raw material and products in many industries.

Many of the measurement techniques have been developed within the Centre allowing the UNSW team to maintain its international reputation for expertise in particulate systems.

The Centre is now part of the Special Research Centre for Multiphase Processes together with the University of Newcastle and Queensland University.

Centre for Remote Sensing and Geographic Information Systems

Director:
Dr R Lucas

The Centre is a joint multidisciplinary enterprise 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.

The Centre's research interests include applications of artificial intelligence in digital photogrammetry and remote sensing, radar backscattering and radar inferometry, and vegetation mapping from remote sensing images. Other interests include monitoring urban areas using high resolution satellite remotely sensed data, data modelling and 3D visualisation, spatial information systems for road based transport planning, evaluation and design. Applications using imaging 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 and South America, China and Europe.

Schools associated with 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.

The Schools involved in the Centre are the Schools of Geography and Geology in the Faculty of Science and Technology and the School of Geomatic Engineering in the Faculty of Engineering.

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 Science and Technology. 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 Science and Technology 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 Science and Technology 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:

Faculty of Science and Technology
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
Master of Engineering Science in GIS, 8652
Graduate Diploma in Remote Sensing 5496

Centre for Water and Waste Technology

Director:
Professor T.D. Waite

The Centre for Water and Waste Technology was established with a grant provided by the Australian Water Advisory Council.

The Centreís 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 in the fields of water and wastewater treatment and solid waste and management.

Energy Research, Development and Information Centre (ERDIC)

Director:
Dr GD Sergeant

UNSW is a major centre for energy research and development in Australia across the full spectrum of energy technologies and issues. The University has internationally recognised expertise in fossil fuels technology, coal, oil, gas and biomass; solar energy, photovoltaic, thermal, passive, energy storage, vanadium batteries; energy efficiency in manufacturing, processing, buildings and transport, and economics and socio-economics.

ERDIC produces an annual report on all these activities; organises inter and multidisciplinary seminars and workshops on both current research and development, and future directions; publishes reports and newsletters; organises lectures; serves as a focal point for enquiries on energy research and development; and assists in bringing multidisciplinary teams together for consultation and research projects.

ERDIC has established itself as an internationally recognised Centre, providing a contact point for energy researchers in many disciplines within the University. It assists Federal and State Governments and industry to determine future policies and directions on energy research and development.

ERDIC disseminates information on energy issues via its seminars, workshops, meetings and newsletters. It is also a point of enquiries in the wider community for information on energy technologies; particularly new and improved energy technology which are the key to safe, efficient and environmentally acceptable production and use of energy.

The Centre is also involved in the production of educational material. It has put together a twelve unit subject on energy management which is offered as a subject in the Master of Business and Technology Program at the University. The

program is structured to enable it to be offered in packages of various units as shorter courses, both in Australia and overseas.

Graduate Programs in Business and Technology

Director:
Adjunct Prof John Toohey

While Graduate Programs in Business and Technology (GPBT) is located within the Faculty of Engineering, it manages several inter-faculty programs. These are; the Master of Business and Technology (MBT), the Master of Technology Management (MTM) and the Master of Commerce (Open Learning). The MBT can be taken on campus or by distance mode. The MTM is a one year full-time on campus program for more recent graduates.

The faculty of Engineering is the Course Authority for the MBT and the MTM and the Faculty of Commerce and Economics is the Courses Authority for the MCom (Open Learning).

UNESCO Centre for Membrane Science and Technology

Directors:
Professor HGL Coster (Biophysics Group)
Professor AG Fane (Chemical Engineering Group)

Deputy Director Dr DE Wiley (Chemical Engineering)

The Centre for Membrane Science and Technology was formed in 1987 as a collaborative venture between the School of Chemical Engineering and Industrial Chemistry and the Department of Biophysics . In 1988 it was granted Commonwealth Special Research Centre status and funding, and in 1992 it became one of only four UNESCO Science Centres worldwide.

Research programs include fundamental research on both biomembranes, and membrane processes, as well as synthetic (industrial) membranes; membrane based manufacturing processes (chemical and biological reactor systems); product purification; purification of water; treatment and safe disposal of wastes, including sewage; biomedical applications; and membrane based biosensor technology. Other activities include the development of novel conducting membranes, membrane biophysics, membrane pervaporation and supported liquid membranes, and membrane-based systems using metal binding liquids to remove heavy metals.

The Membrane Centre maintains connections with membrane groups in China, Indonesia, Japan, Korea, Thailand, Indonesia, Malaysia and Singapore. It also has close links and collaborative projects operating with research institutes in Italy, France, Germany, Denmark, Finland, The Netherlands, the United Kingdom, the United States and Canada.

The Centre organises postgraduate study programs, with up to half of its 25 students coming from countries other than Australia. It also offers shorter-term training programs for overseas trainees in aspects of membrane science and technology and runs specialist workshops on a diverse range of membrane related subjects.

Munro Centre for Civil and Environmental Engineering

Director:
Associate Professor R Cox

The Munro Centre for Civil and Environmental Engineering was established in the School of Civil and Environmental 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.

Centre for Postgraduate Studies in Civil and Environmental Engineering

Director:
Associate Professor R Cox

The Centre offers specialist short courses of 1 to 5 days for practising Civil and Environmental Engineers. The courses are offered under the Munro Centre for Civil and Environmental Engineering.

Photovoltaics Special Research Centre

Director:
Professor MA Green

The Photovoltaics Special Research Centre was established in 1991 under the Australian Research Councilís Research Centres Program. Its function is to carry out research into improved performance, lower cost photovoltaic solar cells and develop a coordinated 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 and Telecommunications

UNSW Groundwater Centre

Director:
Dr R I Acworth

The UNSW Groundwater Centreís facilities are based at the Water Research Laboratory in Manly Vale and in the School of Geology in the Faculty of Science and Technology.

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, Botswana Germany, Ireland and China 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 Science and Technology and Engineering postgraduate students. Information on the centreís courses is listed under the School of Civil and Environmental Engineering section in this handbook or the School of Geology section in the Faculty of Science and Technology handbook. The following programs are available.

8022.2000
Master of Applied Science in Groundwater Studies
The Master of Applied Science degree is undertaken through the School of Geology in the Faculty of Science and Technology

8612
Master of Engineering Science in Groundwater Studies
The Master of Engineering Science idegree is undertaken through the School of Civil and Environmental Engineering in the Faculty of Engineering.

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 and Environmental Engineering in the Faculty of Engineering.

5458
Graduate Diploma in Waste Management
The Graduate Diploma is undertaken through the School of Civil and Environmental 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 ëHandbook Guideí, 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.

ACCT5901
Accounting: A User Perspective
Staff Contact: School Office
S1 L3 CP15

This subject is primarily for the users rather than the preparers of accounting information. The focus is on the understanding and the use of accounting information; the composition and meaning of the financial statements prepared for resource providers in accordance with the law and contractual arrangements; and accounting systems and reports designed for the decision makers within an organisation.

ACCT5915
Individual Judgement and Choice
Staff Contact: School Office
S1 L3 CP15

This subject focuses on behavioural decision theory in the context of judgements made by users of accounting information, managers and auditors. Topics include: introduction to the fields of behavioural decision theory and decision analysis; limitations of human ability to process information; descriptive models of individual choice behaviour; other factors affecting judgement and choice; structuring of a problem; assessing consequences measurement and weighting of dimensions; assessing uncertainties probability assessment, confidence, group decision making; evaluation of alternatives choice of criterion; decision making; evaluation of alternatives choice of criterion; decision analysis involving multiple objectives and choice under uncertainty; ambiguity and choice; relationship between individual choice and organisational choice.

ACCT5917
Strategic Management: Systems and Processes
Staff Contact: School Office
S1 L3 CP15

This subject explores the process and practice of strategic management – the constitution of an organisationís 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.

ACCT5931
Strategic Management Accounting
Staff Contact: School Office
S1 L3 CP15
Prerequisite: ACCT5901 or ACCT5930 or equivalent.

This subject investigates various ways to allocate and manage organisational resources in a competitive environment. The focus is on value creation and cases are used to examine contemporary Australian and international best practice. Topics include value chain analysis; shareholder and customer value; strategic partnering and alliances; and selected topics from strategic management accounting such as benchmarking, the Du Pont methodology and product life cycle profitability.

ACCT5932
Public Sector Accounting and Financial Reporting
Staff Contact: School Office
S1 L3 CP15
Prerequisite: ACCT5901 or ACCT5930 or equivalent

A review of accounting methods applied by Commonwealth, State and Local Government entities. Fund accounting and cash-based reporting. Accrual-based reporting including a review of the issues associated with the measurement of assets and liabilities in the public sector. Infrastructure assets, heritage assets, and obligations arising from complex transactions. Departmental and whole of government reports. Issues arising from the ëcommercialisationí of government units. Identification and costing of community service obligations. Performance indicators and the evaluation of financial performance and service quality.

ACCT5949
Managerial Dynamics
Staff Contact: School Office
S2 L3 CP15

This subject examines the management of a technical specialty or specialist function (for example, the provision of accounting services) in an organisation. Topics include: service provision in ëintelligent enterprisesí; technical specialists as managers; the nature of managerial work; managing patterns of interaction, discourse politics, commitment, ambiguity and change. Numerous case studies are used to examine issues.

ACCT5956
Management Planning and Control
Staff Contact: School Office
S2 L3 CP15

Planning and control processes in organisations, and the involvement of management and management support personnel with them. Topics include: ëformalí and ëorganisationalí perspectives on management planning and control; planning and decision-making in organisations – some alternative perspectives and descriptions; planning and budgeting – theoretical perspectives and organisational descriptions; organisation structures and structuration; control processes in organisations some alternative perspectives; participation as a mode of organisational control; accounting control systems some alternative perspectives; designing management accounting systems prescription or organisational choice; categorising and evaluating the literatures on management planning and control.

ACCT5996
Management Accounting Control Systems
Staff Contact: School Office
S2 L3 CP15
Prerequisite: ACCT5901 or ACCT5930 or equivalent

This subject examines the design and operation of management accounting systems in organisational settings. Topics include: the function of management accounting systems in organisations; design and organisational choice; design and operation of activity based costing systems; budgetary systems outcomes and processes; design and operation of accounting control systems responsibility accounting systems, standard costing and flexible budgets, relationships among accounting systems and administrative, social and personal control systems, divisional performance evaluation, transfer pricing.

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 B Freeman
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.

ANAT2151
Introductory Functional Anatomy
Staff Contact: Dr K Ashwell

An overview of basic human anatomy and physiology with an emphasis on structures and systems which are most vulnerable to chemical and physical trauma under industrial conditions, such as the eye, ear and skin. Other systems studied include the musculo-skeletal system, central and peripheral nervous systems, circulatory, respiratory, gastrointestinal, endocrine and urogenital systems.

ANAT2211
Histology 1
Staff Contact: A/Prof P Waite
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.

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, hybridisation of Orbitals. Periodicity of Physical and Chemical Properties of Chemical compounds.

Organic Chemistry including Stereoisomerism.

CHEM1401
Introductory Chemistry A
Staff Contact: Dr P Chia
CP15 S1 HPW6
Prerequisites: HSC Mark Range Required: 2 unit Mathematics 60–100, or 3 unit Mathematics 1–50, or 4 unit Mathematics 1–100.
Note/s: This subject is only for students who do not have the prerequisite for CHEM1101. Students proceeding to CHEM1101 must attain a mark of 60 or higher.

Stoichiometry and solution stoichiometry. States of matter, changes of state, phase diagrams, gases, liquids, solids, solutions. Equilibrium, introduction to organic chemistry.

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.

CHEM1807
Chemistry 1ME
Staff Contact: Dr P Chia
CP10 S2 HPW2
Note/s: Restricted to Courses 3610, 3663, 3680, 3685 and 3700

Stoichiometry. Atomic and molecular structure and bonding. States of matter. Colligative properties of solutions. Chemical equilibrium. Ionic equilibria. Electrochemistry and corrosion. Introduction to organic chemistry, structure and properties of polymers, fuels and lubricants. 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, electrochemistry and corrosion. Colloids and clays. Colligative properties of solutions. Applications of chemical principles to engineering.

CHEM1807
Chemistry 1ME
Staff Contact: Dr P Chia
CP10 S1 HPW4
Note/s: excluded CHEM1101, CHEM1201, CHEM1002 Restricted to Course 3681

Stoichiometry. Atomic and molecular structure.States of Matter. Equilibrium. Oxidation and reduction, electrochemistry and corrosion of metals. Introduction to organic chemistry, structure and properties of polymers, fuels and lubricants.

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, temperature and concentration dependence of reaction rates, reaction mechanisms

CHEM2021
Organic Chemistry
Staff Contact: Dr R Read
CP15 F or S2 HPW6
Prerequisites: CHEM1101, CHEM1201

Applications of spectroscopy in structure elecidation. Reactive intermediates, addition and rearrangement reactions, carbonyl group chemistry. Chemistry of aromatic compounds.

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 coordination 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.

CHEM3829
Organic Chemistry
Staff Contact: Prof D Black

The spectroscopic identification of organic compounds, free radical chemistry and electroorganic processes, various aspects of the organic industrial processes such as industrial synthesis based on petrochemicals, and organometallic reactions of industrial interest. Selected topics from the dyestuff, pharmaceutical and agricultural industries.

ECON5103
Business Economics
Staff Contact: A/Prof G Kingston
S1 or S2 L3 CP20

An introduction to economic analysis and policy. Using a case study approach, students will examine government and business reports, magazine and newspaper articles, and monographs/journals dealing with contemporary economic issues. Reports or articles will be analysed using simple micro and macroeconomic tools and reasoning. The aim of the subject is to improve the economic literacy of students.

ECON5116
Environmental Economics
Staff Contact: A/Prof G Waugh
S2 L3 CP20
Prerequisite or *Corequisite:* ECON5103

Note/s: Not offered in 1999

ECON5248
Business Forecasting
Staff Contact School Office
S1 L3 CP20
Prerequisite: ECON5203

This subject looks at the use of econometric and statistical techniques relevant to forecasting in a business environment and computer implementation of the methods. Short-term forecasting using time series analysis, long-term forecasting with S-shaped growth curves and trend analysis. The study of applied work is emphasised in this non-specialist course.

FINS5511
Corporate Finance
Staff Contact: School Office
S2 L3 CP20
Prerequisites: ACCT5901 and ECON5103 and ECON5203

Essential aspects of financial decision-making in business. Designed to enable the student to usefully employ the following concepts in a business environment: investment decisions under uncertainty; cost of capital structure; mergers and takeovers; and working capital management.

FINS5512
Australian Capital Markets
Staff Contact: School Office
S1 or S2 L3 CP20
Prerequisites: ECON5103 and ECON5203

Analysis of the markets for the financial assets including the money, bond, stock and futures markets; the structure of interest rates; flow of funds of financial institutions; the regulatory structure of markets and the interrelations among markets.

FINS5513
Security Valuation and Portfolio Selection
Staff Contact: School Office
S1 or S2 L3 CP20
Prerequisites: ECON5103 and ECON5203

The aim of this subject is twofold: (i) to introduce students to theoretical building blocks in the theory of finance; and (ii) to illustrate these by means of a combination of tutorial problems and case studies. Topics include: investment decisions under certainty; investment decisions under uncertainty (the portfolio selection problem); capital asset pricing model and arbitrage pricing theory: rudiments of theory and evidence; fundamentals of bond valuation; introduction to duration and the term structure of interest rates; valuation of equity shares; market efficiency: fads, bubbles, martingales.

GEOG2811
Introduction to Remote Sensing
Staff Contact: School Office
CP15 S2 L2 T2

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.

GEOG2721
Soils and Landforms
Staff Contact: Mr J Sammut
CP15 S1 L2 T2

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

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, emphasising 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.

GEOG9012
Remote Sensing Applications
Staff Contact: Dr R Lucas
CP15 S1 L2 T2

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.

GEOG9011
Environmental Impact Assessment
Staff Contact: School Office
CP15 S1 L2 T2

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.

GEOG3761
Environmental Change
Staff Contact: School Office
CP15 S1 L2 T2

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.

GEOG3711
Biogeography
Staff Contact: A/Prof M Fox, Mr J Sammut
CP15 S1 L2 T2

The characteristics of Australiaís physical and biotic environment: geology, climate, geomorphology, soils, vegetation and fauna. The problems of exploiting Australiaís water and land resources including the degradation of land by erosion, salinisation and soil fertility decline; and habitat loss and fragmentation.

GEOG9023
Vegetation Management
Staff Contact: A/Prof M Fox
CP15 S1 L2 T2

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.

GEOG9014
Computer Mapping and Data Display
StaffContact: School Office
CP15 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.

GEOG9016
Principles of Geographic Information Systems
Staff Contact: School Office
CP15 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.

GEOG9017
Advanced Geographical Information Systems
Staff Contact: School Office
CP15 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.

GEOG9020
Application and Management of Geographical Information Systems
Staff Contact: School Office
CP15 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.

GEOG9021
Image Analysis of Remote Sensing
Staff Contact: Dr R Lucas
CP15 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.

GEOL5211
Geology for Mining Engineers 1
Staff Contact: Dr MB Katz
CP10 F L1 T1
Note/s: Fieldwork of up to 1.5 days is a compulsory part of this subject. Students will incur personal costs.

Main branches of geology and their application to mining. Introduction to mineralogy, petrology, stratigraphy and geomorphology. Rock weathering; Structural geology; faults, folds, joints and foliation. Plate tectonics. The use of geological maps.

GEOL5301
Introduction to Petroleum Geology
Staff Contact: Dr PG Lennox
CP7.5 S1 L2 T1
Note/s: Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.This is a servicing subject taught within courses offered by other schools or faculties.

Introduction to earth science, nature and properties of rocks and minerals; sedimentation, sedimentary structures and sedimentary environments; stratigraphy and the geological time scale, geologic maps and structures; introduction to plate tectonics. Minerals under the microscope. Microscopic features of sandstone and limestone. Nature and identification of clay minerals. Coal and Petroleum formation; development of sedimentary basins.

GEOL5311
Geology for Mining Engineers 2
Staff Contact: Dr MB Katz
CP20 F L1 T2
Note/s: Fieldwork of up to 1 day is a compulsory part of this subject. Students will incur personal costs.This is a servicing subject taught within courses offered by other schools or faculties.

Structural Geology including stereographic projection and fracture analysis as applied to mining operations. Origin and properties of coal, oil, oil shale and natural gas. Principles of hydrogeology including the significance of groundwater in mining operations. Mineralogy of important metallic and non-metallic resources, processes of ore formation. Exploration methods.

GEOL5312
Petroleum Geology and Geophysics
Staff Contact: A/Prof CR Ward, Dr PG Lennox
CP7.5 S2 L2 T1
Prerequisite: GEOL5301
Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Petroleum Geology: Petroleum generation, including kerogen types and maturation migration, entrapment and degradation; Sedimentary features of reservoir squences; Structural traps, diapirs and fractured-rock reservoirs, including coal-bed methane; primary and secondary porosity development; exploration techniques and resource evaluation; case studies of selected petroleum fields. Petroleum Geophysics: fundamentals of seismic wave propagation, seismic data acquisition, seismic data processing, seismic interpretation, three dimensional seismic methods, case studies, vertical seismic profiling.

GEOL5401
Petroleum Production Geology and Geophysics
Staff Contact: Dr PG Lennox, Mr D Palmer
CP5 S1 L1.5T5
Prerequisite: GEOL5312
Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Petroleum exploration and development programs; sub-surface maps and sections; geologic characteristics of selected reservoir types: porosity characteristics and recovery effects; estimation of petroleum resources. Interpretation and application of 2D and 3D seismic reflection data. Structural maps, amplitude seisimic velocities, amplitude versus offset and frequency effects. Estimation of petroleum resources.

GEOL5410
Geology for Mineral Engineers
Staff Contact: A/Prof CR Ward, Dr MB Katz
CP5 S2 L2
Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Nature and properties of coal; methods of testing and analysis; introduction to coal petrology; geological factors in coal preparation and use. Chemical and physical properties of rock forming and economic minerals.

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.

GEOL5211
Geology for Mining Engineers 1
Staff Contact: Dr MB Katz
CP10 F L1 T1
Note/s: Fieldwork of up to 1.5 days is a compulsory part of this subject. Students will incur personal costs.

Main branches of geology and their application to mining. Introduction to mineralogy, petrology, stratigraphy and geomorphology. Rock weathering; Structural geology; faults, folds, joints and foliation. Plate tectonics. The use of geological maps.

GEOL5301
Introduction to Petroleum Geology
Staff Contact: Dr PG Lennox
CP7.5 S1 L2 T1
Note/s: Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.This is a servicing subject taught within courses offered by other schools or faculties.

Introduction to earth science, nature and properties of rocks and minerals; sedimentation, sedimentary structures and sedimentary environments; stratigraphy and the geological time scale, geologic maps and structures; introduction to plate tectonics. Minerals under the microscope. Microscopic features of sandstone and limestone. Nature and identification of clay minerals. Coal and Petroleum formation; development of sedimentary basins.

GEOL5311
Geology for Mining Engineers 2
Staff Contact: Dr MB Katz
CP20 F L1 T2
Note/s: Fieldwork of up to 1 day is a compulsory part of this subject. Students will incur personal costs.This is a servicing subject taught within courses offered by other schools or faculties.

Structural Geology including stereographic projection and fracture analysis as applied to mining operations. Origin and properties of coal, oil, oil shale and natural gas. Principles of hydrogeology including the significance of groundwater in mining operations. Mineralogy of important metallic and non-metallic resources, processes of ore formation. Exploration methods.

GEOL5312
Petroleum Geology and Geophysics
Staff Contact: A/Prof CR Ward, Dr PG Lennox
CP7.5 S2 L2 T1
Prerequisite: GEOL5301
Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Petroleum Geology: Petroleum generation, including kerogen types and maturation migration, entrapment and degradation; Sedimentary features of reservoir squences; Structural traps, diapirs and fractured-rock reservoirs, including coal-bed methane; primary and secondary porosity development; exploration techniques and resource evaluation; case studies of selected petroleum fields. Petroleum Geophysics: fundamentals of seismic wave propagation, seismic data acquisition, seismic data processing, seismic interpretation, three dimensional seismic methods, case studies, vertical seismic profiling.

GEOL5401
Petroleum Production Geology and Geophysics
Staff Contact: Dr PG Lennox, Mr D Palmer
CP5 S1 L1.5T5
Prerequisite: GEOL5312
Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Petroleum exploration and development programs; sub-surface maps and sections; geologic characteristics of selected reservoir types: porosity characteristics and recovery effects; estimation of petroleum resources. Interpretation and application of 2D and 3D seismic reflection data. Structural maps, amplitude seisimic velocities, amplitude versus offset and frequency effects. Estimation of petroleum resources.

GEOL5410
Geology for Mineral Engineers
Staff Contacts: A/Prof CR Ward, Dr MB Katz
CP5 S2 L2
Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Nature and properties of coal; methods of testing and analysis; introduction to coal petrology; geological factors in coal preparation and use. Chemical and physical properties of rock forming and economic minerals.

INFS1603
Business Data Management
Staff Contact: School Office
S1 HPW3 CP15
Prerequisite: Nil

This subject provides students with the required knowledge and practical skills to model date including the use of entity/ relationship models and object models. Students will be able to design simple databases in an organisational environment and have an understanding of the role of data in business and an understanding of the quality assurance issues in collecting, storing and using data.

INFS2603
Systems Analysis and Design
Staff Contact: School Office
S1 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; telecommunications services and other options; data security.

INFS2610
Reuse and Windows Programming
Staff Contact: School Office
S1 HPW3 CP15
Prerequisites: COMP1021 or COMP1811 or INFS2609
Corequisite: INFS2603

The subject aims to demonstrate the importance of reuse in commercial software development in achieving developer productivity, reduced maintenance, and improved software reliability. The subject covers: developing object-oriented programs to achieve reuse; graphical user interface development with a commercial class library; application frameworks; software library navigation; finding and evaluating potential reuse targets; cost-benefit tradeoffs in reuse.

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 formalising 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: Approval of the Head of School of Information Systems

INFS4891
Decision Support Systems
Staff Contact: School Office
S1 L3 CP15
Prerequisite: INFS2603

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 systems are examined as are executive information systems and computer mediated communications within organisations.

INFS5848
Information Systems Project Management
Staff Contact: School Office
S2 L3 CP20
Prerequisite: INFS5988

An introduction to the central concepts and issues of project management and the practical benefits of project planning and management together with resource management. Practical sessions in project planning and the use of a computer based management tool. Additional topics include customer focus, lifecycle customisation, work packages, progress monitoring, risk evaluation, quality management, people skills, and negotiation skills. Case studies of and examples from software development projects wil be used as illustrations.

INFS5928
Software Engineering Management
Staff Contact: School Office
S1 L3 CP20
Prerequisite: INFS5988

Software engineering management and measurement of complex systems, software development maturity, project planning and management, estimation models and techniques, project scheduling, software quality, reliability, assurance, software productivity models. The teaching mode is a mix of formal lectures, seminars and workshops with an emphasis on cooperative discussions.

INFS5953
Information Systems Management
Staff Contact: School Office
S2 L3 CP20
Prerequisites: INFS5988 and INFS5992

This subject aims to assist students to develop their knowledge and understanding of important issues involved in the management of information systems in organisations and their ability to critically analyse these issues. Management of information systems will be considered at strategic, tactical and operational levels. Particular emphasis will be given to the management of enterprise-wide and inter-organisational systems and planning for their strategic use. Students without knowledge of and experience in management or the use of IS in organisations may wish to take the subject INFS4848/INFS5848 before this subjects.

INFS5957
Information and Decision Technology
Staff Contact: School Office
S1 L3 CP20

The role of information and models in managerial decision making and prediction. The role of information systems in decision making. Assessing the value of information systems and the contribution of information in decision making under uncertainty. The role of information in managerial prediction and forecasting. The development of computer based models to support tactical management.

INFS5983
Business Data Communications
Staff Contact: School Office
S2 L3 CP20
Prerequisite: INFS5988

Data communication networks, interfaces between networks and computers, data communications software, standard communication protocols, network architectures, distributed databases, design of information systems which include data communications.

INFS5988
Business Information Systems
Staff Contact: School Office
S1 L3 CP20

This subject aims to provide an introduction to the use and management of information systems in business. This

subject will assist students to develop their knowledge and understanding of the role of information systems in business organisations, and components and disciplines which comprise information systems. This subject will also assist students to develop their capabilities to critically apply the disciplines of information systems and to use application software in support of typical managerial tasks. Application software will include word processing, spreadsheets and personal databases.

INFS5989
Information Systems Design
Staff Contact: School Office
S2 L3 CP20
Prerequisite: INFS5988

An understanding of the role and expectations of a systems analyst in the context of the organisational environment, exploring and using the tools and techniques available to the systems designer, expanding and building on the framework of analysis and design acquired from the other subjects and student experiences.

INFS5992
Data Management
Staff Contact: School Office
S1 L3 CP20

A review of data management principles including both simple and complex file designs, and the concept of database management systems. Alternative database management system architectures, including network hierarchical and relational approaches. Database query systems, including relational algebra. Case studies and assignments embodying these principles.

IROB2721
Managing People
Staff Contact: Dr David Morgan
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 socialisation 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.

IROB5701
Australian Industrial Relations
Staff Contact: A/Prof B Dabscheck
S1 L3 CP20

Concepts and issues in Australian industrial relations at the macro or systems level, with overseas comparisons where appropriate. Labour movements and the evolution of employee-employer relations in the context of industrialisation and change; origins and operations of industrial tribunals at the national and state levels; their instrumentalities; nature of industrial conflict and procedures for conflict resolution such as arbitration and bargaining; national wage policy.

IROB5702
Industrial Relations in the Global Economy
Staff Contact: Dr I Hampson
S2 L3 CP20
Prerequisite: IROB5701

This subject focuses on the ëglobal shiftsí in economics and industry that are driving transformations in many national IR systems. As such the subject shares many of the objectives of comparative IR, namely to foster an appreciation of the merits of comparing IR systems, and the use of comparative method. Since one of the major uses of comparative arguments is in the sphere of industrial relations policy, the subject also aims to review debates about the links between IR systems on the one hand, and national competitiveness and social protection on the other.

IROB5711
Employment and Industrial Law
Staff Contact: School Office
S1 L3 CP20
Prerequisites: IROB5701 or equivalent

Nature and purposes of the legal system and industrial law, the law concerning the contract of employment. Trade union law. Industrial law powers of governments. The Commonwealth and New South Wales conciliation and arbitration systems. Awards. Penal sanctions for industrial law. Industrial torts. Topics and issues of importance in the employment and industrial law field.

IROB5712
Negotiations, Bargaining and Advocacy
Staff Contact: Ms S Hammond
S2 L3 CP20
Prerequisite: IROB5701 or equivalent

This subject aims to give students studying industrial relations and/or human resource management practical skills in the areas of industrial and workplace negotiation, bargaining and advocacy. The subject examines the content, character and making of industrial awards and agreements, with special emphasis on industrial tribunal processes and negotiation and advocacy in relation to paid employment. Students also receive a practical grounding in the requirements of particular policies and regulations governing employment relations, including Enterprise Bargaining, Equal Opportunity and Affirmative Action, Occupational Health and Safety, and Termination of Employment. In addition, the subject provides appropriate theoretical perspectives on these and related employment issues.

IROB5713
Public Policy and Employment
Staff Contact: A/Prof B Dabscheck
S2 L3 CP20
Prerequisite: IROB5701 or equivalent

The formulation and implementation of public policy impacting upon industrial relations and employment.

Theories of the state; public policy models. Current policy issues and options. The interaction between tribunals, parties and public policy evaluation of policy process in Australian and comparative terms. Case studies.

IROB5900
Social and Organisational Analysis
Staff Contact: School Office
SS L3

This subject examines the core concepts and theories underlying modern organisational practice, drawing principally from the discipline of sociology. Topics covered include the evolution and development of social and organisational theory, sociological paradigms and implications for organisational analysis, bureaucracy, organisational design and development, and current topics such as regulation and privatisation, participative democracy and the future of Australian manufacturing industry. A practical focus is maintained through the use of Australian case studies.

IROB5901
Organisational Behaviour
Staff Contact: Mr J Holt
S1 or S2 L3 CP20
Note/s: Excluded PSYC7100.

This subject seeks to explain human behaviour within organisations. It draws predominantly from the behavioural science disciplines of psychology and social psychology. Its foci are the individual, the group, and the behavioural processes involved in organisation integration, change and development. Topics covered include personality, attitudes and values, motivation and learning, interpersonal behaviour, group dynamics, leadership and teamwork, decision-making, power and control.

IROB5903
Organisational Change and Development
Staff Contact: Dr A Bordow
S1 L3 CP20
Prerequisite: IROB5901 or IROB5701

The theory and practice of change in organisations with special attention to applied behavioural science methods for achieving sustained improvement in performance at the individual, group and system levels. Methods and topics examined include: diagnostic approaches, organisational culture and change, action research, organisational learning, strategic planning for change, organisational transitions, structural redesign, teambuilding and skills of change agent intervention.

IROB5904
Corporate, Management and Union Strategy
Staff Contact: School Office
S2 L3 CP20
Prerequisite: IROB5901 or equivalent

This subject deals with theories of strategy, strategic planning and implementation, and the concept and exercise of strategic choice. It is distinguished from conventional managerial approaches to strategic planning by its application to labour-management-relations and by its inclusion of trade union strategies. For both organised labour and for management, the management of strategy is a particular focus of the subject.

IROB5906
Human Resource Management in Context
Staff Contact: Dr L Taksa
S1 L3 CP20

Theories of organisational behaviour and management will be examined in order to locate Human Resource Management in historical, conceptual and practical contexts. Changing factors that shape the organisation of work, worker and managerial responses and action will be considered with specific focus on their relationship to power, conflict, control, motivation, group interaction and culture. The role of Human Resource Management in the implementation of organisational change will be included.

IROB5907
Human Resource Management Processes
Staff Contact: Dr L Taksa
S2 L3 CP20
Prerequisite: IROB5906 or IROB5701 or IROB5901 or equivalent

Theoretical foundations of Human Resource Management; power and authority of HRM function. Examination of policies and strategies developed by employers to organise and reward their employees. Values underlying such policies; controversies surrounding their development and implementation; the way in which organisational dynamics influence their operation. The interface between HRM policies and the regulatory, social and organisational contexts; the operation of HRM policies in different business sectors and countries.

IROB5912
International Dimensions of Organisational Behaviour
Staff Contact: Mr J Holt
S2 L3 CP20
Prerequisite: IROB5901 or equivalent

This subject provides a comparative focus to the study of organisations in global context by exploring how organisation, management and employment systems differ across cultural frameworks. The effects of culture on the structure of national organisational systems, corporate transnational systems, and international HRM are also examined. Other topics include the transferability of management systems and techno-cultures across cultural boundaries, and the ěconvergence versus divergenceí thesis. Where possible, case studies contrasting Asian with Australian perspectives are used.

IROB5914
Employee Communications
Staff Contact: Dr A Bordow
S1 L3 CP20
Prerequisite: IROB5901 or equivalent

This subject provides for an understanding of how human communication works within organisational domains and

especially examines communication as an influence process. The basics of interpersonal, organisational and mass communication together with public relations will be reviewed in order to proceed to the study of such applications as communicating to employees en masse, effecting appropriate media choice, informing stakeholders and interested publics, and developing a corporate information policy. All students will take part in a learning augmentation, called a virtual class room, to enhance their awareness of a new communications technology and will carry out a field investigation within an ongoing organisation.

IROB5915
Human Potentialities
Staff Contact: Dr A Donovan
S2 L3 CP20
Prerequisite or Corequisite: IROB5901 or equivalent

This subject follows an empirical and experiential approach to the study of human potentialities. Issues explored include: human dominance and destructiveness; the dynamics of awareness; intentionality and holonomy; skilled performance; human creativity; the individuation process; methods of realising potential, perennial and modern.

IROB5920
Men and Women in Organisations
Staff Contact: Dr L Taksa
S2 L3 CP20

This subject presents a multi-disciplinary overview of the issues and problems pertaining to gender relations in organisations. It evaluates a range of concepts and methods necessary for understanding the processes and structures responsible for the current position of men and women as employees and managers in both the public and private sectors. Topics covered from the perspective of gender relations include: labour market segmentation, industrial relations theory and practice, the role of the state, organisational power and politics, Equal Employment Opportunities and the functioning of the merit principle and the use of post-modernist theory for understanding the operation of human resource management and organisational culture.

IROB5921
Management in Cross-Cultural Contexts
Staff Contact: School Office
SS L3 CP20

This subject examines how the dynamics of culture impact on the process of managing organisations in culturally diverse settings. Topics include: conceptual and methodological issues related to the study of culture; the psychological and sociological basis of cultural variation; the role of culture in shaping work-related cognitions; the problematics and implications of cultural variation for the functions of cross-cultural management such as inter-cultural communication; cross-cultural leadership; cross-cultural negotiation; and cross-cultural awareness. Other issues such as transferability and the convergence and divergence thesis are also addressed.

IROB5947
Performance Management
Staff Contact: School Office
SS L3 CP20
Prerequisite: IROB5900

The subject focuses on the coordination and execution of organisational work tasks. It covers the relation between organisational strategy and the purposes of separate units, setting objectives, formal monitoring and performance evaluation, appraisal systems and job design, performance related pay and renumeration. Critical issues centred on managing equity, affirmation action and equal opportunity and the role of social and work norms in performance are covered.

IROB5948
Human Resources Development
Staff Contact: School Office
SS L3 CP20
Prerequisite: IROB5900

This subject focuses on the skills, career and occupational development of people in organisations. Human resource planning, gap analysis of supply and demand, training, needs analysis, learning systems, program development, internal and external training policy, career planning and internal labour markets are key topics in the subject. Recruitment and selection, management development, employee contribution and trade union involvement are among other areas addressed.

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 ëpublic lawí, 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; Australiaís constitutional development; the separation of powers, responsible government and constitutional conventions; and the republicanism debate.

LAWS2150
Federal Constitutional Law
StaffContact: 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 ëreal propertyí. 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 directorsí 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 lawyersí duties to accept work, to keep client confidences, to act competently and to avoid conflicts of interest; the social implications of lawyersí professional behaviour. 2. The adversary system of litigation and the lawyersí 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 specialisation in lawyersí practice, the structure and availability of legal aid, the regulation of lawyersí fees, the extent of the lawyersí 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 computerised legal research methods. The methods and objectives of legal and empirical research.

LAWS7420
Advanced Legal Research
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.

LAWS3409
Environmental Law and Policy
Staff Contact: School Office
CP30 F HPW2

This subject examines environmental law in Australia in a policy setting. Environmental law is interpreted broadly to refer to all relevant regulatory frameworks, including both statutory and common law ones, as well as relevant international administrative and legal arrangements. The primary focus will be the NSW context, but environmental issues of a global, regional and national nature will also be addressed. The law will be examined in an inter-disciplinary way, referring to economic, sociological, historical and philosophical analysis, with reference being also made to comparative environmental law. Particular topics of a conceptual kind include: how environmental problems are defined and what form they take; competing values (e.g. anthropocentric versus ecocentric perspectives) and how such values are articulated (through, e.g., public participation) in order to develop public policy responses to environmental problems; and theoretical aspects of policy development and evaluation, referring to cost-benefit analysis and risk assessment, spillover effects, the nature of public goods, and issues of justice in the distribution of environmental costs and benefits. Consideration of legal techniques for giving effect to environmental policies will cover such matters as: property law, including private and common property rights, conservation covenants, heritage agreements; tort law; forward planning and the planmaking process; project control; environmental impact assessment; pollution control; self-regulatory measures; and issues of enforcement. Alternatives to legal regulation for the achievement of

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.

LAWS5020
Occupational Health and Safety Law
Staff Contact: Prof Adrian Brooks
CP15 SS HPW4

The law relating to compensation for work-related injuries and disabilities and to the regulation of safety standards in workplaces. Topics include: the employerís common law duty of care; the common law duty of care of manufacturers of products for use at work; the development and application of workersí compensation schemes; existing protective legislation in Australia; individual rights under protective legislation.

LEGT5511
Legal Foundations of Business
Staff Contact: School Office
S1 or S2 L3 CP20

Law is an important foundation of modern business decisions. In any business decision fundamental legal questions may arise about the potential liabilities of the parties, the rights that the parties have and how the business or transaction should be organised. This subject introduces the Australian legal system; outlines alternative forms of business organisation; discusses the legal framework of business regulation; and examines areas of law particularly relevant to business such as the law of contract, law relating to specialised commercial transactions, the regulation of restrictive trade practices and sales promotion.

LEGT5531
Legal Regulation of Business
Staff Contact: School Office
S2 L3 CP20
Prerequisite: LEGT5511 or equivalent or approval from the Head of School

Trade practices and fair trading laws have assumed fundamental importance in the Australian market place. This subject examines the regulation of restrictive trade practices under the Trade Practices Act 1974 (Commonwealth) and the Competition Code with particular reference to collusive activity, distribution methods, pricing arrangements, abuse of market power, mergers and access to essential facilities. This subject also examines major fair trading initiatives under the Trade Practices Act and

State and Territory Fair Trading legislation with particular reference to misleading or deceptive conduct, unconscionable conduct, advertising and marketing strategies and product liability. Aspects of the protection of intellectual property are also examined.

LEGT5541
Company Law
Staff Contact: School Office
S1 L3 CP20
Prerequisite: LEGT5511 or equivalent or approval from the Head of School

The law relating to business organisations, including partnerships, joint ventures, trading trusts, and companies incorporated under the Corporations Law. The primary focus is on company law and, in particular, the significance of the corporate entity; groups of companies, the division of corporate control amongst directors, management and shareholders and their respective roles, the duties of directors, share and debt capital, funding raising, enforcement of shareholdersí rights, insolvency and liquidation.

LEGT5551
Revenue Law
Staff Contact: School Office
S2 L3 CP20
Prerequisite: LEGT5511 or equivalent or Approval from the Head of School

A series of major changes beginning in the mid 1980s have transformed the Australian tax system. The complexity and comprehensiveness of the Australian tax system now mean that tax considerations now are of major importance in most business decisions. After outlining tax policy, tax mix and tax reform, considerations, this subject concentrates on income taxation in Australia. Topics include: concepts of income; allowable deductions; tax accounting; taxation of partnerships; trusts and corporations; anti-avoidance provisions; tax administration; capital gains tax; and fringe benefits tax.

LEGT5561
Legal Aspects of Finance
Staff Contact: School Office
S1 L3 CP20

Commercial structures including companies, joint ventures, partnerships and trusts. Procedures for equity and debt financing of entrepreneurial schemes with special reference to both law and practice. The regulation of the securities market. Corporate restructuring and take-overs, mergers and reconstructions. The law of company charges. Aspects of the taxation of commercial financing.

LEGT5562
Business Law in a Global Economy
Staff Contact: School Office
S1 L3 CP20

Developments in technology, telecommunication and deregulation which have taken place in the latter part of this century have led to the creation of a global economy. This subject addresses the legal environment of this economy and aspects of its operation. Topics include the laws and practices relating to international sales agreements; arrangements for conducting business, including franchising; licensing, joint ventures and technology transfer; international financing arrangements; and the resolution of disputes.

LEGT5571
Franchising
Staff Contact: School Office
S1 L3 CP20

Franchising is becoming the dominant force in the distribution of goods and services. This subject examines the nature, development and significance of franchising in the Australian and international economies and addresses relevant legal and commercial issues. The legal nature and commercial implications of other distribution strategies – technology transfers, trademark licensing, character and personality merchandising are also examined.

MARK5902
Elements of Marketing
Staff Contact: School Office
S1 + S2 L3 CP20
Prerequisite or corequisite: one core unit

The course is a blend of theory and practical application. The central theme running throughout the teaching program is that marketing is not a fragmented assortment of actions and functions taking place among disconnected institutions operating in isolation. Rather it is a total system of business action. The task of managing a marketing operation involves strategic and tactical decision making. It also demands an understanding of the structure of the marketing system, the various institutions that make up that system, and the role of each institutions that make up that system, and the role of each institution within the system.

MARK5903
International Marketing
Staff Contact: School Office
S1 L3 CP20
Prerequisites: MARK5902, MARK5911 , MARK5928

Character and dimension of the political, economic, modernisation (including administrative) and social aspects affecting international marketing; the dynamic relationship between the environmental aspects and international domestic marketing. Operational aspects of international marketing; nature of competition marketing structure and channels, trade barriers, etc., as well as international, regional, sub-regional economic groupings with emphasis on marketing in Asia, particularly Japan.

MARK2012
Marketing Fundamentals
Staff Contact: School of Marketing Office
CP15 S2 L2 T2
Prerequisites: ACCT1501, ECON1101, ECON1202

Major concepts and theories relevant to the study and practice of marketing are introduced. Topics include the

changing global marketplace, market processes and planning, the use of market research, an understanding of consumers and customers, decision-making and the marketing mix, market segmentation, positioning and product differentiation. The introductory subject prepares students for future study across the broad spectrum of product, service, consumer, business-to-business, industrial, global and social marketing

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, ECON1202, 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, ECON1202, 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, ECON1202, 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, ECON1202, ECON2290, ECON2291.

As for MATH1231 but in greater depth.

MATH2009
Engineering Mathematics 2
Staff Contact: School of Mathematics Office
CP20 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. The higher equivalent of MATH2001 is the pair of subjects MATHS2110 and MATH2610

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, Stokesí theorem, Greenís 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
Staff Contact: School Office
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.

MATH2021
Mathematics 2
Staff Contact: School of Mathematics Office
CP15 F HPW2
Prerequisite: MATH1021(CR) or MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Taught by the Keller plan self-paced learning method.

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; multiple integrals, matrices and their application to theory of linear equations, eigenvalues; introduction to numerical methods

MATH2031
Mathematics 2CH
Staff Contact: School of Mathematics Office
CP20 F HPW2.5
Prerequisite: MATH1231or MATH1241
Note/s: Not available to Sciencestudents. taught by the Keller Plan self-paced learning method.

Revision of Integration and differential equations; partial differentiation, chain rules, grad, div, curl and Laplacian, vector operators in polar coordinates; simple partial differential equations (Wave equations, Heat equation, Laplace's equation);integration in 2 and 3 dimensions, examples illustrating Green's strokes' and divergence theorems, integration over curved regions; Fourier series, use in solving some partial PDE's and Laplace's equation for a rectangle; Laplace transforms use in solving ordinary and partial PDEs and Laplace equation for a rectangle ; Laplace transforms, use in solving ordinary and partial Des, transforms of error functions, Unit and delta function; Taylor polynomial solutions of ODEs-Legendre polynomials, Frobenius method - Bessel functions, applications including wave equation for a circular drum; Matrices, applications.

MATH2100
Vector Calculus
Staff Contact: School of Mathematics Office
CP7.5 S2 HPW2.5
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2110, MATH2011.

Properties of vectors and vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss and Stokesí 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 of Mathematics 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. Besselís equation and Legendreís equation. Partial differential equations: characteristics, classification, wave equation, heat equation, Laplaceís 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, orthogonalisation, reflections and QR factorisations. Eigenvalues and eigenvectors, diagonalisation. 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. Cauchyís 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, MATH2870, 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.

MATH2819
Statistics SA
Staff Contact: School of Mathematics Office
CP10 F HPW2
Prerequisite: MATH1021 or MATH1032 or MATH1231 or MATH1042 or MATH1241

Probability, random variables, independence. Binomial, Poisson and normal distributions, transformations to normality, estimation of mean and variance, confidence intervals, tests of hypotheses, contingency tables, two sample tests of location, simple and multiple linear regression, analysis of variance for simple models.

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
CP7.5 S1 HPW3
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2841, MATH2870, 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 linear regression.

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 or MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2801, MATH2821, MATH2901, MATH2921, MATH2819, MATH2870, 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, MATH2870, 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 of Mathematics Office
CP5 S1 HPW2
Prerequisite: MATH1021 or MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Excluded MATH2841, MATH2870, 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.

MATH2899
Applied Statistics for Chemical Engineers
Staff Contact: School of Mathematics Office
CP7.5 S2 HPW3
Prerequisite: MATH1231 or MATH1241
Note/s: Not available to Science Students

Graphical data analysis. Review of probability, random variables and their properties. The normal and binomial distributions, the central limit theorem. Applications to statical quality control. Theory of statistical inference including confidence intervals and hypothesis testing with applications to one and two sample problems based on the t-and F-test. Simple and multiple linear regression including data transformations to normality. Design and analysis of experiments, analysis of variance, introduction to factorial designs. Applications will be drawn primarily from the fields of chemical, bioprocess and petroleum engineering. Statistical computing will be based on Matlab.

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, MATH2870, 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.

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.

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

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 factorisations, orthogonalisation, iterative methods for linear systems and eigenvalue problems, optimisation.

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

Fickís 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.

Physics Level I Subjects

Notes: Where mathematics subjects are specified as prerequisites or as corequisites, the higher levels of such subjects are acceptable and preferable. The total value of the combination of PHYS1022 and PHYS1002 is 45 Credit Points.

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) 65–100, or 2 unit Science (Chemistry) 75–100, or 3 unit Science 100–150, 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 Kirchoffís laws to AC and DC circuits. Uniform circular motion, Keplerís 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.

PHYS1918
Physics 1 (Mechanical Engineering)
Staff Contact: First Year Director
CP15 S1 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) 65–100, or 2 unit Science (Chemistry) 75–100, or 3 unit Science 100–150, 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
Note/s: Re-run in S2

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. Alternating currents.

PHYS1969
Physics 1 (Electrical Engineering)
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) 65–100, or 2 unit Science (Chemistry) 75–100, or 3 unit Science 100–150, 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.

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
CP12.5 S1 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) 65–100, or 2 unit Science (Chemistry) 75–100, or 3 unit Science 100–150, 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.
Note/s: Re-run in S2.

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
CP15 S1 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) 65–100, or 2 unit Science (Chemistry) 75–100, or 3 unit Science 100–150, 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.

Vectors, linear mechanics. Newtonís laws of motion, rotational mechanics. Electric forces, fields and potential, magnetic forces and fields. Ampereís Law, Faradayís Law, Electric circuit theory, AC, DC and transient circuits. Geometrical optics and instruments. Fluid mechanics; Bernoulliís equation, viscosity; Stokeís 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, Lagrangeís 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, Gaussí law, Poissonís and Laplaceís equations, capacitance, dielectrics and polarisation, magnetism, electro-magnetic induction, Maxwellís equations, electromagnetic waves. Laws of thermodynamics, kinetic theory, microscopic processes, entropy, solid state defects, Helmholtz and Gibbs functions, Maxwellís 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.

PHYS2920
Electronics (Mining Engineering and Industrial Chemistry)
Staff Contact: Executive Assistant
CP7.5 S1 HPW3
Prerequisite: PHYS1022 or PHYS1002
Note/s: Excluded PHYS2031, PHYS2630

The application of electronics to other disciplines. Includes principles of circuit theory; amplifiers, their specification and application, transducers; electronic instrumentation; industrial data acquisition.

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 concepts. Superconductivity. Maxwellís 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

Digital electronics. CCD arrays and computerised image enhancement. Analog to digital conversion. Transducers including direct digital output. Wave motion. Geometrical optics. Physical optics including interference, diffraction and polarisation. Optical instruments: telescopes, image brightness and resolution, photography.

PHYS2999
Mechanics and Thermal Physics (Electrical Engineering)
Staff Contact: Executive Assistant

Particle mechanics, harmonic motion, central force problems, systems of particles, Lagrangeís equations with applications, coupled oscillations, wave equation. Thermodynamic laws, entropy, kinetic theory, M-B distribution, microscopic processes, Maxwellís relations,

chemical potential, phase diagrams, multicomponent systems, electrochemical potential, statistics of defects in solids.

Physics Level III Subjects

Note: See notes for Physics Level II subjects.

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; Maxwellís 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 superconductivity. Fourier optics, holography.

PHYS3120
Experimental Physics B2
Staff Contact: Executive Assistant
CP7.5 S2 HPW4
Prerequisite: PHYS2031

As for PHYS3110 Experimental Physics B1.

PHYS3210
Applied 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.

PHYS3230
Applied Electromagnetism
Staff Contact: Executive Assistant
CP7.5 S1 HPW2
Prerequisites: PHYS2011, MATH2011, MATH2120
Excluded: PHYS3030

Note/s: Not available to Advanced Science students in programs 0100, 0121, 0161.

Review of Maxwellís equations in integral and differential form, boundary conditions, applications to plane electromagnetic waves in vacuum and material media, dispersion, reflection and transmission, waves in waveguides, fibres and cavaties, dipoles and antenna systems.

PHYS3710
Lasers and Applications
Staff Contact: Executive Assistant
CP7.5 S1 HPW2
Note/s: Offered in odd-numbered years only.

Interaction between light and matter, fundamental properties of laser amplifiers and oscillators, giant pulse generation, mode locking and Q switching, specific laser systems including gas lasers and semiconductor lasers, applications of lasers.

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.

SAFE9011
Physical Principles of Safety
Staff Contact: Prof Jean Cross
CP12

Solid mechanics: Force systems, friction equilibrium and stability, linear and rotational motion, energy, momentum, collisions, simple machines, stress strain relationships, bending stress, applications in safety and biomechanics. Fluid mechanics: properties of fluids, static and dynamic pressure in flowing systems, laminar and turbulent flow, friction losses. Forces on submerged objects, buoyancy, ship stability. Hydraulic and pneumatic systems. Applications in biomechanics, safety and ventilation.

SAFE9012
Statistics for Health and Safety Scientists
Staff Contact: Ms Dianne Gardner
CP12

The subject is designed to provide an introduction to the theory of statistics and to those statistical techniques which are relevant to planning and management of health and safety services. The subject covers statistical methods which are a prerequisite to the study of epidemiology, risk management, ergonomics and behavioural studies. Topics include analysis of frequency distributions elementary probability theory, Binomial, Normal and Poisson distributions, elementary sampling theory, statistical decision theory and Hypothesis testing, t test, Chisquare test and elementary correlation theory. Illustrative data is drawn from statistics relevant to health and safety.

SAFE9211
Introduction to Safety Engineering
Staff Contact: Dr Tony Green
CP12
Assumed knowledge: SAFE9011 or PHYS1022

The engineering improvement of potentially hazardous workplace situations with reference to the following: safety management, safety audits, basic safety practice, management of dangerous materials; fire and explosion; ventilation; radiation protection; electrical safety; machine dangers and machine guarding; construction safety; transport safety; environmental safety; plant safety assessment; safety issues in different industries.

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, emphasising 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.

SAFE9232
Introduction to Occupational Health and Safety Law
Staff Contact: Head of School
CP12

The concept of law: the creation and interpretation of statutes: the judicial and court systems: locus standi: common law and equity: basic principles of legal liability (civil and criminal): basic principles of administrative law and the liability of the Crown: the common law of employment: statutory regulation of employment: compulsory arbitration of industrial disputes. Outline of occupational health, safety and compensation legislation of the Australian States. Actions under the common law.

SAFE9242
Effective Behaviour in Organisations
Staff Contact: Ms Dianne Gardner
CP12

Human behaviour as a major system factor in occupational safety and health. Learning and safety programs. Attitudes and attitude change. Safety compliance individual and group factors affecting compliance. Work motivation and safety practice. Accident proneness and personnel selection. Individual differences in attitudes to work. Planning and implementing organisational change.

SAFE9260
Introduction to Occupational Health
Staff Contact: A/Prof Chris Winder
CP12

This subject provides an outline of the inter-relationships between the roles of some of the occupational health and safety disciplines (notably occupational hygiene, occupational medicine, epidemiology and toxicology) as well as studies of some common occupational hazards, their outcomes on health and possible options for workplace control.

SAFE9261
Occupational Hygiene
Staff Contact: A/Prof Chris Winder
CP12
Assumed knowledge: SAFE9260

This subject deals with practical considerations of recognising, evaluating and controlling workplace hazards. Topics include the role of the occupational hygienist; types of workplace hazards (such as particulates, gases and vapours, chemicals, noise, radiation, temperature, biohazards); workplace assessment and monitoring; and methods for the control of hazards (such as ventilation and personal protection).

SAFE9262
Occupational Medicine
Staff Contact: A/Prof Chris Winder
CP12
Assumed Knowledge: SAFE9260

This subject provides sessions on significant occupational diseases of the respiratory system, skin, eye, musculo-skeletal system and reproductive system, as well as occupational cancer and infectious diseases. The subject also covers other occupational medicine principles and activities, including assessing risks to worker health, health surveillance, health promotion and rehabilitation.

SAFE9263
Chemical Safety and Toxicology
Staff Contact: A/Prof Chris Winder
CP12
Assumed Knowledge: SAFE9260

This subject provides an outline of the toxicological, occupational hygiene and environmental aspects of chemical hazards and exposures.

SAFE9265
Occupational Health Practice
Staff Contact: A/Prof Chris Winder
CP12
Assumed Knowledge: SAFE9262

A workplace assessment based subject, where students will be required to report on occupational health problems following visits to a number of diverse industrial sites.

SAFE9271
Environmental Planning and Assessment
Staff Contact: Dr Boban Markovic
CP8

This subject is a core element for the Graduate Diploma and Masters of Environmental Studies courses and provides the conceptual framework for understanding interactions between humans, nature, philosophy, law, politics, ethics and decision making and how this related to environmental planning and assessment. Also available as SAFE8271 (distance learning).

SAFE9272
Environment and Medicine
Staff Contact: A/Prof Chris Winder
CP8

Aspects of medicine bearing upon physiological consequences of pollutants. Metabolic mechanisms; chemical interactions, synergism and antagonism; photosynthesis and phytotoxicity. Ozone depletion and greenhouse effects. Morbidity and mortality surveys. Studies of particular pollutants and environmental contaminants.

SAFE9273
Environment and Law
Staff Contact: A/Prof Chris Winder
CP8

Resources in law for the preservation of the environment. Types of legislation: local government, town planning, environmental and common law; administrative infrastructure, problems and actions. The North American experience. Economic and sociological factors.

SAFE9274
Environmental Management Systems
Staff Contact: Dr Boban Markovic
CP12
Assumed Knowledge: SAFE9271

This subject is designed to define the central role of environment in management strategies. It describes the development of different approaches to fulfill the demands of the environment while considering not only the current legislative requirements but also customer requirements, competitive pressure and safety aspects of the firms respectively. Available as a short course.

SAFE9343
Innovation, Productivity and Safety
Staff Contact: Ms Dianne Gardner
CP12

Behaviour of people in organisation, Individuals, groups and organisations: Planning for innovation and change; Dealing with human problems, including resistance to change; Human capabilities and limitations in the physical, perceptual and cognitive reactions with the operating system. The cost benefit of failsafe design (in relation to human operators) vs post design training. Operator efficiency and operator safety. The human barriers to designing and operating the system with these joint priorities. Recent advances in defining and controlling human error and their implications for equipment design and for management and training systems.

SAFE9350
Risk Management
Staff Contact: Prof Jean Cross
CP12

This subject gives an overview of Risk Management following the format of the Draft Australian Standard in Risk Management. Tools and techniques applicable to each step of the risk management process are discussed using examples applicable to the class. The same risk management process is applied to manage a very wide range of business issues including health and safety, the environment, finance and project management. This subject is therefore relevant as part of a wide variety of postgraduate courses and students from any postgraduate course are accepted if numbers permit. The student selects examples forexercises to suit the industry and role in which they work (or intend to work). At the end of the subject students should be able to use risk management tools applicable to their specific interest and have an awareness of tools used in other industries and applications.

SAFE9354
Issues in Safety Management
Staff Contact: Ms Dianne Gardner
CP12

This subject covers a range of issues in the management of risks in industry. It covers the planning, implementation and evaluation of risk management programs. Theoretical issues and practical applications in areas such as decision making, best practice, cost-benefit analysis, program implementation and program evaluation are covered and applied to health and safety, project management and other industrial risks. Case studies, discussion and other interactive approaches ensure active participation of class members. Students are expected to play an active role in class, to participate in discussions, to question and to share their own experiences and insights with others. From time to time, guest lecturers will be invited to present subject material. Also available as SAFE8354 (distance learning)

SAFE9424
Applied Ergonomics
Staff Contact: Mr Roger Hall
CP12
Prerequisite: SAFE9224 or equivalent

Decision making, vigilance, effects of workload and stress, applications to screen-based equipment. Human error in relation to human/system interaction. Work systems: the systems approach, practical evaluation and redesign of work systems. Experimental methodology, experimental design in ergonomics, critical evaluation of the literature.

SAFE9426
Ergonomics and New Technology
Staff Contact: Mr Roger Hall
CP12
Assumed Knowledge: SAFE9224 or equivalent

The focus of this subject is on ergonomic issues related to the design and implementation of new technology. Cognitive aspects of human-computer interaction, human error and software design, useability and its assessment, user interface design, evaluation techniques, guidelines and standards, and the introduction of new systems into organisations.

SAFE9543
Management of Dangerous Materials
Staff Contact: A/Prof Chris Winder
CP12
Assumed Knowledge: 1st year Chemistry

This subject covers chemicals legislation, regulatory assessment of chemicals, chemical information (labels/ MSDS), workplace management of chemical safety (Workplace assessment, exposure control, storage of chemicals, personal protection, monitoring), emergency preparedness, pollution, management of hazardous wastes and disposal.

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.

SAFE9551
Experimental Biomechanics
Staff Contact: Prof Noel Svensson
CP12

Objectives and ethics of biomechanical experimentation, statistical evaluation of results. Experimentation involving movement analysis, exercise physiology, muscular activity, mechanical properties of skeletal materials, anthropometric surrogates.

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 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 the University, together with the publication in which the conditions for the award appear.

Higher Degrees

For the list of graduate degrees by research and course work, arranged in faculty order, see *UNSW Courses (by faculty)* in the *Calendar*.

Title	Abbreviation	Calendar/Handbook
Higher Degrees		
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Education	EdD	Arts and Social Sciences
Doctor of Juridicial Science	SJD	Law
Doctor of Medicine	MD	Medicine
Doctor of Philosophy	PhD	Calendar and all handbooks
Master of Architecture	MArch	Built Environment
Master of Archives Administration	MArchivAdmin	Commerce and Economics
Master of Art	MArt	College of Fine Arts
Master of Art Administration	MArtAdmin	College of Fine Arts
Master of Art and Design Education	MArtDesEd	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 (English)	MA(English)	University College
Master of Arts (Honours)	MA(Hons)	Arts and Social Sciences
Master of Art Theory	MArtTh	College of Fine Arts

Title	Abbreviation	Calendar/Handbook
Master of Biomedical Engineering	MBiomedE	Engineering
Master of Building	MBuild	Built Environment
Master of the Built Environment (Sustainable Development)	MBEnv	Built Environment
Master of the Built Environment (Building Conservation)	MBEnv	Built Environment
Master of Business Administration	MBA	AGSM
Master of Business Administration (Executive)	MBA(Exec)	AGSM
Master of Business and Technology	MBT	Engineering
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 Computer Science	MCompSc	Engineering
Master of Construction Management	MConstMgt	Built Environment
Master of Couple and Family Therapy	MCFT	Arts and Social Sciences
Master of Defence Studies	MDefStud	University College
Master of Design(Honours)	MDes(Hons)	College of Fine Arts
Master of Drug Development	MDD	Medicine
Master of Education	MEd	Arts and Social Sciences
Master of Educational Administration	MEdAdmin	Arts and Social Sciences
Master of Engineering	ME	Science* Engineering University College
Master of Engineering *without supervision*	ME	Science* Engineering
Master of Engineering Science	MEngSc	Engineering University College
Master of Environmental Engineering Science	MEnvEngSc	Engineering
Master of Environmental Studies	MEnvStudies	Science and Technology
Master of Equity & Social Administration	MEqSocAdmin	Arts and Social Sciences
Master of Fine Arts	MFA	College of Fine Arts
Master of Health Administration	MHA	Medicine
Master of Health Professions Education	MHPEd	Medicine
Master of Health Planning	MHP	Medicine
Master of Higher Education	MHEd	Arts and Social Sciences
Master of Housing Studies	MHS	Arts and Social Sciences
Master of Industrial Design	MID	Built Environment
Master of Information Management	MIM	Commerce and Economics
Master of Information Science	MInfSc	Engineering
Master of International Social Development	MIntSocDev	Arts and Social Sciences
Master of Medicine	MMed	Medicine
Master of Landscape Architecture	MLArch	Built Environment
Master of Landscape Planning	MLP	Built Environment
Master of Laws	LLM	Law
Master of Management Studies	MMgtStud	University College
Master of Medicine	MMed	Medicine
Master of Mining Management	MMinMgmt	Engineering
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 Professional Ethics	MProfEthics	Arts and Social Sciences

Title	Abbreviation	Calendar/Handbook
Master of Psychological Medicine	MPM	Medicine
Master of Psychology (Clinical)	MPsychol(Clin)	Science†
Master of Psychology (Forensic)	MPsychol (For)	Science†
Master of Psychology (Organisation)	MPsychol(Org)	Science†
Master of Public Health	MPH	Medicine
Master of Real Estate	MRE	Built Environment
Master of Real Property	MRProp	Built Environment
Master of Safety Science	MSafetySc	Science
Master of Science	MSc	Built Environment Engineering Medicine Science*† University College
Master of Science *without supervision*	MSc	Science* Built Environment Engineering
Master of Science (Industrial Design)	MSc(IndDes)	Built Environment
Master of Science and Society (Honours)	MScSoc(Hons)	Arts and Social Sciences
Master of Science and Technology	MScTech	Science*
Master of Science in Information Technology	MScInfTech	University College
Master of Science in Operations Research and Statistics	MScOpRes&Stats	University College
Master of Social Work	MSW	Arts and Social Sciences
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	Science* Commerce and Economics Engineering
Master of Town Planning	MTP	Built Environment
Master of Urban Development & Design	MUDD	Built Environment

Graduate Diplomas

Graduate Diploma	GradDip	AGSM Built Environment Arts and Social Sciences Commerce and Economics Engineering Law Medicine Science*†
Advanced Taxation	GradDipAdvTax	ATAX
Arts	GradDipArts	Arts and Social Sciences
Arts(English) University College	GradDipArts(English)	
Built Environment (Sustainable Development)	GradDipBEnv	Built Environment
Couple and Family Therapy	GradDipC/F Therapy	Arts and Social Sciences
Clinical Education	GradDipClinEd	Medicine
Community Paediatrics	GradDipCommPaed	Medicine
Defence Studies	GradDipDefStud	University College
Design	GradDipDes	College of Fine Arts
Drug Development	GradDipDD	Medicine
Education	DipEd	Arts and Social Sciences
Engineering Science	GradDipEngSc	University College

Title	Abbreviation	Calendar/Handbook
Environmental Studies	GradDipEnvironStud	Science
Equity and Social Administration	GradDipEq&SocAdmin	Arts and Social Sciences
Geriatric Medicine	GradDipGerMed	Medicine
Higher Education	GradDipHEd	Arts and Social Sciences
Health Professions Education	GradDipHPEd	Medicine
Housing Studies	GradDipHS	Art and Social Sciences
Industrial Management	GradDipIndMgt	Engineering
International Social Development	GradDipIntSocDev	Arts and Social Sciences
Land Administration	GradDipLandAdmin	Engineering
Management Studies	GradDipMgtStud	University College
Music	GradDipMus	Arts and Social Sciences
Paediatrics	GradDipPaed	Medicine
Policy Studies	GradDipPolicy	Arts and Social Sciences
Professional Ethics	GradDipProfEthics	Arts and Social Sciences
Public Health	GradDipPH	Medicine
Sports Medicine	GradDipSpMed	Medicine
Statistics	GradDipStats	Science*
Taxation Studies	GradDipTaxStud	ATAX

Graduate Certificates

Arts	GradCertArts	Arts and Social Sciences
Arts(English)	GradCertArts(English)	University College
Commerce	GradCertCom	Commerce and Economics
Design	GradCertDes	College of Fine Arts
Drug Development	GradCertDD	Medicine
Engineering Science	GradCertEngSc	University College
Geriatric Medicine	GradCertGerMed	Medicine
Health Administration	GradCertHSM	Medicine
Health Professions Education	GradCertHPEd	Medicine
Higher Education	GradCertHEd	Arts and Social Sciences
Information Technology	GradCertInfTech	University College
Management Studies	GradCertMgtStud	University College
Music	GradCertMus	Arts and Social Sciences
Operations Research and Statistics	GradCertOpRes&Stats	University College
Policy Studies	GradCertPolicy	Arts and Social Sciences
Public Health	GradCertPH	Medicine
Safety Science	GradCertSafetySc	Science*
Science and Technology	GradCert	Science*
Sports Medicine	GradCertSpMed	Medicine

*Faculty of Science and Technology
†Faculty of Life 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.

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.

(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.

**'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.*

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.

(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

**'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.*

(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.

(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' and updated on the UNSW Web site http://www.infonet.unsw.edu.au/academic/schopriz/httoc.htm.

Students investigating study opportunities overseas should also consult Study Abroad which is published by UNESCO. The British Council (02 9326 2365) may be of assistance for information about study in Britain. The Australian–American Education Foundation (02 6247 9331) or the U.S. Consulate General Educational Advising Centre (02 9373 9230) 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 and Student Loans 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 (i.e. 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 (e.g. scholarships in Science and Technology or Engineering). If students from more than one Faculty are able to apply the scholarship is listed in the General Scholarships section.

For further information contact:

The Scholarships and Student Loans Unit
The University of New South Wales
Sydney 2052 Australia

Tel (02) 9385 3100/3101/1462
Fax (02) 9385 3732
Email: scholarships@unsw.edu.au
Website: http://www.infonet.unsw.edu.au/academic/schopriz/httoc.htm

Scholarships for students entering the first year of an undergraduate course

General First Year

The Alumni Association Scholarships (I,L)

- Up to $1,500 pa
- 1 year renewable subject to satisfactory progress

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 UNSW. Applications close early January.

The AUSIMM Education Endowment Fund (L)

- $2,500-$5,000 pa
- 1 year may be renewable subject to satisfactory progress

The scholarships are open to full-time undergraduate students enrolled in a course leading to the award of a Geoscience, Mining Engineering or Minerals Engineering (Minerals Processing or Extractive Metallurgy) degree related to the interests of the mineral industry. Further information is available from The Australian Institute of Mining and Metallurgy (AUSIMM), PO Box 660, Carlton South VIC 3053, Tel (03) 9662 3166.

The Australian Development Scholarships (ADS) (I)

- Tuition fees, medical cover, airfare and a stipend
- Duration of the course

This award is for international students from selected countries only. Information and applications can only be obtained from Australian Diplomatic Posts or Australian Education Centres in the home country. Applications normally close at least 12 months before the year of study.

The Australian Vietnam Veterans Trust Education Assistance Scheme (L)

- $3,500 pa
- Duration of the course subject to satisfactory progress

The scholarship is available to the children of Vietnam veterans who are aged under 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 1240, Tel (02) 9281 7077, Email: vvt@accsoft.com.au. 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 active members of a UNSW Sports Club. Applications close late January.

The Captain Reg Saunders Scholarship (L)

- $3,000
- Up to 4 years

Applicants must be Aboriginals or Torres Strait Islanders eligible to commence a university degree in the area of psychology, nursing, applied science, social work or education. Further information and applications are available from the Aboriginal Education Program, UNSW, Tel (02) 9385 3805.

The UNSW Co-Op Program (L)

- $11,150 pa, and between 9 and 20 months industry training
- Duration of the course subject to satisfactory progress

The scholarships are offered by industry sponsors through the University for some of the disciplines in the Faculties of Science and Technology, 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 UAI of 93.8 is expected. The UNSW Co-Op Program application form is available from school Careers Advisers or the Co-op Program 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 Ian Somervaille Scholarships (I,L)

- Up to $3,000
- 1 year

The scholarships are available to immediate family members (ie. children, parents, brothers, sisters, spouses, de facto partners) of UNSW staff members. Applicants must be full-time students enrolling in any year of an undergraduate course leading to the degree of Bachelor at UNSW. Selection will be based on academic merit, aptitude and commitment to the proposed course. Consideration may be given in cases of hardship or disadvantage. Applications close 31 January.

The John Niland Scholarships (L)

- $5,000
- 1 year

The scholarship assists rural students to undertake 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 Kensington Colleges Scholarships

Further information concerning the awards below is available from The Kensington Colleges, Tel (02) 9315 0000, Fax (02) 9315 0011, Email: kenso-colleges@unsw.edu.au, Web: http:\\www.kensocoll.unsw.edu.au.

The Mathews Scholarship

The scholarship provides $1,500 credit towards accommodation costs and is awarded to a resident at the commencement of the second year of an undergraduate degree. Candidates will be assessed on their academic performance in the first year of their course.

The Access Scholarship

The scholarship provides up to half the accommodation fee for a limited number of first year ACCESS scheme students experiencing long term financial hardship. Nominations are forwarded by the UNSW ACCESS office.

The Malcolm Chaikin Scholarship (L)

- $15,000 pa
- Renewable for the duration of the course subject to satisfactory progress

The scholarship is available to students entering the first year of a Bachelor of Science or Engineering in the Faculties of Life Sciences, Science and Technology, or Engineering. Selection will take into account academic merit and interview performance. Applications close 31 October.

The National Health and Medical Research Council (NHMRC) Training Scholarship for Aboriginal Health Research (L,R)

- $15,888 - $23,630 pa (depending on qualifications)
- Up to 3 years

Applicants must be undertaking an undergraduate or postgraduate degree which includes, or leads to, research relevant to Aboriginal health. Applications will be assessed in terms of previous qualifications and experience. Consideration will be given to prior knowledge and experience of Aboriginal culture and health. Applications close early August.

The New College Access Scholarship

The scholarship provides up to half of the accommodation fee for a first year ACCESS scheme student selected by the College. Nominations are forwarded by the UNSW ACCESS office. For further information contact New College, Tel (02) 9381 1999, Fax (02) 9381 1919, Email: admissions@newcollege.unsw.edu.au.

The New South Scholarships (L)

- $6,000
- 1 year

The scholarships are available to students commencing the first year of undergraduate study at UNSW in any discipline. Scholarships will be available only to those students who achieved a perfect score in the NSW HSC in the year prior to commencing study. No application form is required.

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 and Student Loans Unit once known.

Robert Riley Scholarships (L)

- $5,000

The Scholarships are awarded to promote the pursuit of justice and human rights for Aboriginal Australians through education. Applicants must be Aboriginals or Torres Strait Islanders up to the age of 25 and proposing to pursue studies in the fields of law, human rights or juvenile justice. Further information and applications are available from the Aboriginal Education Program, UNSW, Tel (02) 9385 3805. Applications close 1 November.

The Smith Family Tertiary Scholarship Scheme (I,L)

- Up to $2,000 for University fees, books, laboratory/field or practical fees
- 1 year

The scheme offers scholarships to first year undergraduate students from disadvantaged families who demonstrate high academic ability and the personal commitment to succeed in tertiary studies. Applicants must be economically disadvantaged, as assessed by The Smith Family, and have demonstrated consistently high academic results. Applications are available from The Education Support Co-ordinator, The Smith Family, Locked Bag 1000, Camperdown NSW 2050, Tel (02) 9550 4422, fax (02) 9516 4063. Applications close late July.

The Vice-Chancellor's Equity Scholarships (L)

- $1,500
- 1 year

In 1998, over 40 scholarships were awarded for financially disadvantaged students commencing full-time undergraduate study. Consideration is normally given to academic merit and financial need. The conditions may change each year.

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.

Faculty First Year

Faculty of Engineering

The Alexandria Ada Lam Scholarship (L)

- $1,000 pa
- 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. 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 Faculty of Engineering Undergraduate Scholarships (L)

- $2,000
- 1 year

At least 100 Faculty of Engineering Undergraduate Scholarships are available. The scholarships are available to full-time students entering the first year of the following undergraduate programs: Aerospace Engineering,

Biomedical Engineering/Chemical Engineering, Biomedical Engineering/Computer Engineering, Biomedical Engineering/Electrical Engineering, Biomedical Engineering/Mechanical Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Computer Science, Electrical Engineering, Environmental Engineering, Geomatic Engineering, Industrial Chemistry, Manufacturing Engineering and Management, Mechanical Engineering, Mechatronic Engineering, Mining Engineering, Naval Architecture, Petroleum Engineering, Software Engineering and Telecommunications Engineering. No application is required. Consideration will be given to students on the basis of their UAI score in the HSC (or equivalent matriculation).

The Jack Beale Scholarship (I,L)

- Up to $1,000
- 1 year

The scholarship is available to a first year student enrolling in the Faculty of Engineering. Applicants should be concerned about water resources and the environment. Applications close 31 October.

The Vida Balshaw Women In Engineering Scholarship (L)

- Up to $2,500
- 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 late January.

Chemical Engineering and Industrial Chemistry

The School of Chemical Engineering and Industrial Chemistry Undergraduate Scholarships (L)

- Up to $1,000
- 1 Year

Scholarships are available to full-time students in the Chemical Engineering and Industrial Chemistry course leading to the degree of Bachelor of Engineering/Bachelor of Science at UNSW. Selection is based on academic merit and interview performance. There is no application. Only applicants for the UNSW Co-Op Program Scholarship will be considered.

Civil Engineering

The Jacob N Frenkel Scholarship in Civil Engineering (L)

- Up to $1,200
- 1 year

The scholarship provides assistance to a student proposing to undertake a Bachelor of Engineering in 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 $1,500 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.

The Surveyor-General's Scholarship for Women in Surveying (L)

- Up to $2,000
- 1 year

The scholarship is available to a female student entering Year 1 of the full-time degree course in Geomatic Engineering. Applications close at the end of January.

Scholarships for students in their second or later year of study

General Second Year or Later

The AITD-MMI Insurance- Mark Pompei Scholarship (L)

- $1,000

The Australian Institute of Training and Development and MMI Insurance offer an annual scholarship to a part-time student currently working in the field of Training and Development. Applicants should be completing their first accredited qualification to assist their development in this field. Applications are available from AITD NSW Division Administrator, PO Box 5452, West Chatswood NSW 2057, Tel (02) 9419 4966, Fax (02) 9419 4142, Email nswdivn@aitd.com.au. Applications close in May.

The Alumni Association Scholarships (I,L)

- Up to $1,500 pa
- 1 year renewable subject to satisfactory progress

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 UNSW. Applications close early January.

The Australian Vietnam Veterans Trust Education Assistance Scheme (L)

- $3,500 pa
- Duration of the course subject to satisfactory progress

The scholarship is available to the children of Vietnam veterans who are aged under 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 1240, Tel (02) 9281 7077, Email: vvt@accsoft.com.au. 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 active members of a UNSW Sports Club. Applications close late January.

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 Dried Fruits Research and Development Council (DFRDC) Studentships and Student Awards (I,L)

- Up to $3,000 for Studentships, up to $1,000 for Student Awards

The Studentships assist students to undertake research projects in the final year of a Bachelors degree (applications close April 15), or to undertake a research project during the summer vacation (applications close October 15). The Student Awards are provided for excellence in student research projects related to the dried fruit industry. Further information and applications are available from the Executive Officer, Dried Fruits Research and Development Council, Box 1142, Mildura VIC 3502, Tel (050) 221515, Fax (050) 233321.

The Esso Australia Ltd Geosciences Scholarship (I,L)

- Up to $3,000
- 1 year

The scholarship is for a full-time student seeking to undertake study in the final year (Year 4) of a Bachelor of Science (AppGeol) or an equivalent Honours year, majoring in geology or geophysics. The successful applicant is expected to have an interest in petroleum related studies ie sedimentology, biostratigraphy, seismic/magnetic/gravity geophysical studies, basin studies, palynology or palaeontology. Selection is based on academic merit, the benefit the student will gain by being awarded the scholarship and can include consideration of financial need. Applications close 30 November.

The Ian Somervaille Scholarships (I,L)

- Up to $3,000
- 1 year

The scholarships are available to immediate family members (ie. children, parents, brothers, sisters, spouses, de facto partners) of UNSW staff members. Applicants must be full-time students enrolling in any year of an undergraduate course leading to the degree of Bachelor at UNSW. Selection will be based on academic merit, aptitude and commitment to the proposed course.

Consideration may be given in cases of hardship or disadvantage. Applications close 31 January.

The Julian Small Foundation Annual Research Grant (I,L)

- Up to $5,000

Applications are open to postgraduate and undergraduate students undertaking research and involved in the study of law, or industrial relations. Selection will be based on a research proposal which outlines how the research will advance thinking and practice in the area of employment law and industrial relations in Australia. Applications close mid-August.

The Kensington Colleges Scholarships

Further information concerning the awards below is available from The Kensington Colleges, Tel (02) 9315 0000, Fax (02) 9315 0011, Email kenso-colleges@unsw.edu.au, Web: http:\\www.kensocoll.unsw.edu.au.

The Fell Scholarship
The scholarship provides $650 credit for accommodation costs and is awarded to a returning resident in each College. Applicants will be assessed on their academic performance in the second or later year of their course.

Resident Assistant Scheme
The program provides subsidised accommodation, valued at up to $1,000, for 22 academically promising residents, and an apprenticeship in the collegiate Residential Academic Staff role. All residents who have successfully completed at least one year of university study are eligible to apply.

The National Health and Medical Research Council (NHMRC) Training Scholarship for Aboriginal Health Research (L,R)

- $15,888 - $23,630 pa (depending on qualifications)
- Up to 3 years

Applicants must be undertaking an undergraduate or postgraduate degree which includes, or leads to, research relevant to Aboriginal health. Applications will be assessed in terms of previous qualifications and experience. Consideration will be given to prior knowledge and experience of Aboriginal culture and health. Applications close late July.

The Nicholas Catchlove Scholarship in Flying (L)

- $10,000
- 1 year

The scholarship will be awarded to provide a final year student with the opportunity to undertake further flying training to prepare for a career in the aviation industry. Applicants must be proposing to undertake the final year of an appropriate course and hold a Commercial Pilot's Licence. Selection will be based on academic merit, reasons for undertaking the course, financial need, commitment to flying and to the course, demonstrated ability, leadership qualities and interview performance. Applications close in late March.

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 the New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000, Tel (02) 9228 3533, Fax (02) 9228 4722.

The RGC Scholarship in Economic Geology (L)

- $5,000
- 1 year

The scholarship is available to a student entering Year 4 of the Applied Geology course or an Honours year in geology in the Science course and who is proposing to undertake a field project relevant to economic geology. Letters of application and requests for information should be directed to RGC, Gold Fields House, 1 Alfred St, Sydney NSW 2000. Applications close 31 January.

The Rural Allied Health Placement Grants (L)

- Up to $500

Grants are available to students undertaking rural placements, who are in the final two years of an undergraduate course in dietetics, diagnostic radiography, occupational therapy, pharmacy, physiotherapy, podiatry, social work, speech pathology, psychology (honours) or any year of a postgraduate course in dietetics or psychology (Masters). Applications are available from the NSW Health Rural Health Support Unit. Tel (02) 6640 2302, Fax (02) 6640 2499, Email: rhsu@nor.com.au, web: www.nor.com.au/community/rhsu. Session One applications close 15 May. Session Two applications close in August.

The Rural Allied Health Scholarships (L)

- $5,750

Scholarships are available to students who are in the final two years of a four year undergraduate course in Aboriginal health, dietetics, diagnostic radiography, occupational therapy, pharmacy, physiotherapy, podiatry, social work, speech pathology, or the final year of psychology (honours) degree or any year of a Masters qualification in dietetics or psychology. Applications are available from the NSW Health Rural Health Support Unit. Tel (02) 6640 2302, Fax (02) 6640 2499, Email: rhsu@nor.com.au, web: www.nor.com.au/community/rhsu. Applications close late September.

The Sam Cracknell Memorial Scholarships (I,L)

- Up to $1,500
- 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 Spruson and Ferguson (Patent Attorneys) Scholarship for Innovation (L)

- At least $1,000
- 1 year

The scholarship is available to a student who is undertaking the final year of an undergraduate course in any school of the Faculty of Science and Technology or the Faculty of Engineering. Selection will be based on academic merit and the innovative nature of the proposed final year project. Applicants are required to submit an application and a 200 word outline of their proposed research topic. Applications close 7 March.

The Telstra Education Fellowships (L)

- $7,500
- 1 year

Applicants must be entering the final year of study in the disciplines of computer, electrical or electronic engineering, computer science or human factors. Students may also have the opportunity to undertake up to 12 weeks non-compulsary vacation employment. Further information is available from the Fellowship Applications Officer, Telstra Research Laboratories, PO Box 249, Rosebank MDC, Clayton Victoria 3169. Email c.zaman@trl.telstra.com.au. Applications normally close at the end of July.

Telstra Network Technology Group and Multimedia (NTG&M) EEO Scholarships (L)

- $10,000, plus summer vacation work and guaranteed employment
- 1 year

The scholarships are open to undergraduate students enrolled in the second last year in electrical/electronic engineering, computers systems engineering, communications or other degree related to telecommunications. Applicants must belong to one of the following EEO groups: women, people from a non-English-speaking background, Aborigines or Islanders, people with a disability. The successful candidates are expected to work for Telstra NTG&M in the summer break and for at least two years after the completion of study. Enquiries to Karen Stewart on (03) 9634 3448, Email kstewart@vcomfin.telstra.com.au. Applications close late June.

The W.S. and L.B. 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.

Faculty Second Year or Later

Faculty of 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 provided to advance the management education of engineers. Selection will be based on academic achievement particularly in the field of management, demonstrated participation and performance in industry. The proposed final year project should be related to management and business performance in an engineering-based enterprise. Applications close 30 April.

The Shell Coal Undergraduate Scholarship (L)

- $5,000 pa
- Up to 3 years subject to satisfactory progress

Applicants must have successfully completed the first year of a degree course in mining, mechanical, environmental, geological, metallurgical or electrical engineering (or equivalent), and wish to pursue a career in mining. Selection will be based on academic and other achievements. Applications close late March.

Chemical Engineering and Industrial Chemistry

The Royston Scholarship in Chemical Engineering (L)

- Up to $1,000
- 1 year

The scholarship is available to a student undertaking Year 4 of the Bachelor of Engineering degree course in Chemical Engineering, with a project in Mineral Process or Fuel Technology. Selection will be based on academic merit and the reasons for undertaking the proposed project/course of study. Applications close 31 October in the year prior to award.

Civil and Environmental Engineering

The PPK Environment and Infrastructure Scholarship (I,L)

- $1,500
- 1 year

The scholarship is available to a student who has completed Year 2 of a degree course in civil or environmental engineering. Selection will be based on academic merit, the reasons for undertaking the course of study, interest in pursuing a career in civil/environmental engineering and interview performance. The Head of School will invite applications from suitably qualified students. Further information is available from the Head of School, Civil and Environmental Engineering, Tel (02) 9385 5018.

Mining Engineering

The BHP Minerals Scholarship in Mining Engineering (L)

- $10,000 pa and payment of HECS
- Up to 3 years subject to satisfactory progress

The scholarship is available to students in the second year of the Mining Engineering degree at UNSW. Selection will be based on academic performance in the first year of the degree. Applications close 31 March.

The Charles Warman Scholarship (L)

- $4,000 pa
- 1 year renewable subject to satisfactory progress

The scholarship is available to students enrolling in Year 3 or 4 of the full-time degree course in Mineral Engineering (BE or BE/BSc). Selection will be based on academic merit. Applications close early March.

The Dyno Nobel Asia Pacific Ltd Scholarship (L)

- Up to $7,000 pa
- 2 years subject to satisfactory progress

The scholarship is available for Years 3 and 4 of the Mining Engineering course. The scholarship is offered every second year and will be offered again in 2000.

The Komatsu Scholarship (L)

- Up to $2,000 payable in two equal instalments
- 1 year

The scholarship is available to the student with the best performance in Year 3 and entering Year 4 of the Mining Engineering course. The student is nominated by the School. There is no application.

The Mintech Scholarship (L)

- Up to $1,000
- 1 year

The scholarship is to be awarded to a full-time student in the final year of the Mining Engineering degree at UNSW. The applicant's thesis topic must be in the fields of drill and blast technology. The scholarship will be awarded on the basis of academic merit and financial need. Applications close 31 March.

The Voest Alpine Scholarship (I,L)

- Up to $3,000 payable in two equal instalments
- 1 year

The scholarship is available to the student with the best performance in Year 2 and entering Year 3 of the Mining Engineering course. The student is nominated by the School. There is no application.

Honours Year Scholarships

General Honours Year

The Alumni Association Scholarships (I,L)

- Up to $1,500 pa
- 1 year renewable subject to satisfactory progress

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 UNSW. Applications close early January.

The Apex Foundation for Research into Intellectual Disability Studentships (I,L)

- $1,000

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. Applications close 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
- Duration of the course

The scholarship is available to the children of Vietnam veterans who are aged under 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 1240, Tel (02) 9281 7077, Email vvt@accsoft.com.au. Applications close 31 October.

The Ben Lexcen Sports Scholarships (I,L)

- $2,000 pa
- 1 year with the 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 active members of a UNSW Sports Club. Applications close late January.

The Esso Australia Ltd Geosciences Scholarship (I, L)

- Up to $3,000
- 1 year

The scholarship is for a full-time student seeking to undertake study in the final year (Stage 4) of a Bachelor of Science degree in Applied Geology or an equivalent Honours year, majoring in geology or geophysics. The successful applicant is expected to have an interest in petroleum related studies ie sedimentology, biostratigraphy, seismic/magnetic/gravity geophysical studies, basin studies, palynology or palaeontology. Selection is based on academic merit, the benefit the student will gain by being awarded the scholarship and can include consideration of financial need. Applications close 30 November.

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 two referees' supporting statements, should be sent to GRDC Undergraduate Honours Scholarship, PO Box E6, Queen Victoria Terrace, Canberra ACT 2600, Tel (02) 62725528. Applications close early 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 Ian Somervaille Scholarships (I,L)

- Up to $3,000
- 1 year

The scholarships are available to immediate family members (ie. children, parents, brothers or sisters) of UNSW staff members or their married or de facto partners. Applicants must be full-time students enrolling in any year of an undergraduate course leading to the degree of Bachelor at UNSW. Selection will be based on academic merit, aptitude and commitment to the proposed course. Consideration may be given in cases of hardship or disadvantage. Applications close 31 January.

The National Health and Medical Research Council (NHMRC) Training Scholarship for Aboriginal Health Research (L,R)

- $15,888 - $23,630 pa (depending on qualifications)
- Up to 3 years

Applicants must be undertaking an undergraduate or postgraduate degree which includes, or leads to, research relevant to Aboriginal health. Applications will be assessed in terms of previous qualifications and experience. Consideration will be given to prior knowledge and experience of Aboriginal culture and health. Applications close late 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 the New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000, Tel (02) 9228 3533, Fax (02) 9228 4722.

The RGC Scholarship in Economic Geology (L)

- $5,000
- 1 year

The scholarship is available to a student entering Stage 4 of the Applied Geology course or an Honours year in geology in the Science course and who is proposing to undertake a field project relevant to economic geology. Letters of application and requests for information should be directed to RGC, Gold Fields House, 1 Alfred St, Sydney NSW 2000. Applications close 31 January.

The River Basin Management Society Ernest Jackson Memorial Research Grants (I,L)

- Up to $2,000

The scholarship assists PhD and Masters students undertaking research in the field of river basin management. Fourth year Honours students are encouraged to apply. Further information is available from RBMS, PO Box 113, Forest Hill Vic 3131, Tel (03) 9816 6896. Applications close in April.

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 (02) 62311437. Applications close 31 March.

The Rural Allied Health Placement Grants (L)

- Up to $500

Grants are available to students undertaking rural placements, who are in the final two years of an undergraduate course in dietetics, diagnostic radiography, occupational therapy, pharmacy, physiotherapy, podiatry, social work, speech pathology, psychology (honours) or any year of a postgraduate course in dietetics or psychology (Masters). Applications are available from the NSW Health Rural Health Support Unit. Tel (02) 6640 2302, Fax (02) 6640 2499, Email: rhsu@nor.com.au, web: www.nor.com.au/community/rhsu. Session One applications close 15 May. Session Two applications close in August.

The Rural Allied Health Scholarships (L)

- $5,750

Scholarships are available to students who are in the final two years of a four year undergraduate course in Aboriginal Health, dietetics, diagnostic radiography, occupational therapy, pharmacy, physiotherapy, podiatry, social work, speech pathology, or the final year of psychology (honours) degree or any year of a Masters qualification in dietetics or psychology. Applications are available from the NSW Health Rural Health Support Unit. Tel (02) 6640 2302, Fax (02) 6640 2499, Email: rhsu@nor.com.au, web: www.nor.com.au/community/rhsu. Applications close late September.

The Sam Cracknell Memorial Scholarship (I,L)

- Up to $1,500
- 1 year

Applicants should be full-time students who have already completed at least 2 years of a degree or diploma course. 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 or science. A letter of application should be sent to Pasminco Mining, PO Box 460, Broken Hill, NSW 2880. Applications close 30 September.

Faculty Honours Year

Faculty of Engineering

Computer Science and Engineering

Department of Computer Systems (DoCS) Thesis Scholarship (I,L)

- $2,500
- 1 year

The scholarships are available to students undertaking the final year thesis in the area of computer systems under the supervision of a DoCS academic. Applicants are expected to have a High Distinction result in at least one computer systems subject. Further information is available from Dr Gernot Heiser, Tel (02) 9385 5156. Applications close one week after the Session 2 assessment deadline.

Travel Scholarships

General Travel

The Arthur Anderson Study Abroad Scholarship (L)

- Up to $2,500

The scholarship provides financial assistance to undergraduate students to undertake a period of study/ research in the Arthur Anderson offices in Singapore. Applicants must be full-time students undertaking study in law, commerce, or economics. Applicants must normally be intending to undertake the final year of study and to complete the travel prior to completion of the final year. Applications are also open to students undertaking an official exchange program with a university in Asia. Applications normally close 31 July in the year prior to the final year of study.

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.

The AT&T Leadership Award (I,L,R,C)

- US$5,000

The award is open to students who will be commencing full-time undergraduate or postgraduate study in the United States between January and September in the year of application. The scholarship is open to students from the following Asia/Pacific countries: Australia, China, Hong Kong, India, Indonesia, Japan, Republic of Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand. Information and applications are available from the U.S. Consulate General, USIS, Level 59 MLC Centre, 19-20 Martin Place, Sydney NSW 2000, Tel (02) 9662 3016. Applications close 15 September.

The Australia-Korea Foundation/National Korean Studies Centre Exchange Scholarships (L)

- Up to $2,500

The scholarships provide financial assistance to undergraduate students who have been accepted as exchange students by a Korean University. Information and applications are available from the Programs Co-ordinator, National Korean Studies Centre, PO Box 218, Hawthorn Vic 3122, Email nksc@swin.edu.au. Applications close early January.

The Australia-Korea Foundation Undergraduate Bursaries (L)

- $1,000
- 1 year

Bursaries are available for students commencing the first year of an undergraduate course intending to study the Korean language. Information and applications are available from the Programs Co-ordinator, National Korean Studies Centre, PO Box 218, Hawthorn Vic 3122, Email nksc@swin.edu.au. Applications close in December.

Churchill Fellowships (L)

- Tuition, travel and living allowances

Churchill Fellowships provide financial support for Australian Citizens to undertake study, training or projects overseas. Fellowships will not normally be awarded for higher academic or formal qualifications. Applicants must be over 18 years of age. Further information and applications are available from the Chief Executive Officer, The Winston Churchill Memorial Trust, 218 Northbourne Ave, Braddon ACT 2612, Tel (02) 6247 8333. Applications close late February.

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 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.

Greek Government Scholarships (L)

- Tuition fees, monthly subsidy plus other allowances

Scholarships are available for undergraduate and postgraduate study in Greece. Applicants must be Australian citizens. Further information is available from the Embassy of Greece, 9 Turrana St, Yarralumla ACT 2600, Tel (02) 6273 3011. Applications normally close late March.

The Harvard Travel Scholarships (L)

- $15,000 contribution towards fees, travel and living expenses
- One-off payment

The scholarship will be awarded by the Vice-Chancellor on the basis of recommendations from the Deans of the Faculties. Candidates must have completed at least 2 years full-time (or the part-time equivalent) of an undergraduate course at the UNSW and have an impressive academic record. Award of the scholarship is subject to the recipient gaining entry to the Harvard-Radcliffe Visiting Undergraduate Program. Applications close mid-November for travel in the following year.

The International Exchange Travel Scholarships (L)

- Up to $1,500
- 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. Further information is available from the International Student Centre, Tel (02) 9385 5333.

Italian Government Scholarships (L)

- 1 million Italian lira per month
- 2-24 months

Scholarships are open to Australian citizens to undertake research and language studies in Italy. Applicants must be aged under 35 years. Further information is available from the Italian Embassy, 12 Grey St, Deakin ACT 2600, Tel (02) 6273 3333, Fax (02) 6273 4223. Applications close early March.

Japan Airlines Scholarships (L)

- Air travel, insurance, tuition, accommodation, textbooks and a daily allowance

The Scholarships are available for undergraduate students to participate in a summer session of Japanese language and cross-cultural studies, home stays in Tokyo and participation at a symposium featuring regional experts. A knowledge of Japanese is not necessary. Further information and applications are available from Level 14, 201 Sussex Street, Sydney NSW 2000, Tel (02) 9272 1151. Applications normally close mid-April.

The Japanese Government (Monbusho) Scholarships (L)

Scholarships are available to Australian Citizens for study in Japan for postgraduate research or five years of undergraduate study. Applicants must be willing to study the Japanese language and receive instruction in Japanese. Further information and applications are available from Monbusho Scholarships, Embassy of Japan, 112 Empire Circuit, Yarralumla ACT 2600, Tel (02) 6272 7268, Fax (02) 6273 1848. Applications close early July.

Learn Arabic in Cairo Scholarship (I,L)

- Course fees, AUD$70 per month living allowance
- 8 months

Scholarships are available to undertake the Arabic as a Foreign Language course in Cairo. Applications are available from the Embassy of the Republic of Egypt, 1 Darwin Avenue, Yarralumla ACT 2600, Tel (02) 6273 4437, Fax (02) 6273 4279. Applications close 1 July.

The Malcolm Chalkin Overseas Exchange Scholarship (L)

- $4,000
- 1 year

A scholarship is available for a third or later year student in a Science or Engineering degree program in the Faculty of Life Sciences, Science and Technology or Engineering. Applicants must have applied for the Malcolm Chaikin Scholarship for 1998 or later, and be undertaking an official overseas exchange program. It is expected that the first scholarship will be awarded for travel in 2000. Applications close 30 September.

The Mitsui Education Foundation Scholarship (L)

A three week 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 in their first degree course who have not previously been to Japan. The successful student will travel to Japan during November and December. Application forms close mid-July.

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 the NSW Ministry for the Arts, GPO Box 5341, Sydney 2001, Tel (02) 9228 5533. Applications normally close in July.

Queen's Trust Grants (L)

- Up to $15,000

The Queen's Trust provides grants to Australian Citizens aged 18-28 years, for the pursuit of excellence in their chosen fields. Projects are supported for the advancement of Australian youth, development of community leadership and/ or other skills which will be of benefit to Australia. Information and applications may be obtained from the Queen's Trust, Tel 1800 033 625. Applications close late April.

The R.C. Sutton/ Jardine Matheson Scholarship (L)

- Up to $1,000

The scholarship is to provide financial assistance to undergraduate students to undertake a period of study/ research in the R.C. Sutton/ Jardine Matheson offices in Asia. Applicants must be full-time students undertaking study in law, commerce, or economics. Applicants must normally be intending to undertake their final year of study and to complete the travel prior to completion of the final year. Applications are also open to students undertaking an official exchange program with a university in Asia. Applications normally close 31 July in the year prior to the final year of study.

The Rotary Foundation Ambassadorial Scholarships (I,L)

The Rotary Foundation offers scholarships to study or train in another country where Rotary clubs are located. Applicants must have completed at least two years of a university or college course , or have completed high school and have been employed for at least two years. Applicants must also be Citizens of a country in which there is a Rotary club. Information regarding scholarship availability, closing dates and applications should be obtained from the applicant's local Rotary club.

The Russian Scholarships (L)

- Payment of an allowance and medical cover

Scholarships are available to Australian citizens to undertake undergraduate or postgraduate study in journalism, law, economics, international relations or medicine in Russia. Applications normally close in May.

The Ship for World Youth Program (L)

- Economy airfare, accommodation, local trips and meals
- Awarded every second year

The objective of this program is to promote understanding and mutual friendship between the youth of Japan and other parts of the world and to foster the spirit of international cooperation. The successful applicants will visit Japan to participate in the program for the period January to March. Students should be aged from 20 to 29, able to participate in the whole program, be in good physical and mental condition, able to speak English and Japanese, have an interest in and an understanding of Japan, and be engaged in youth activities. The next round of scholarships will be available in 2001. Applications close early July 2000.

The Sir Charles Mackerras / Australia-Britain Society Music Scholarship (L)

- £8,000 sterling

The scholarship is open to outstanding young conductors, composers and repetiteurs, aged between 21 and 30 who are likely to be influential leaders in the field of music, to undertake study in the United Kingdom or the Czech republic for at least six months. Applicants must be Australian Citizens or Permanent Residents. Application forms are available from the British Council, PO Box 88, Edgecliff NSW 2027, Tel (02) 9326 2022, Fax (02) 9327 4868, Email bcsydney@sprint.com. Applications close early November.

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 mid-April.

The Swedish Institute Guest Scholarships (I, L)

- SEK 7,100 per month living allowance
- 9 months (1 academic year)

The scholarships are open to students and researchers who wish to travel to Sweden for study or research which cannot equally well be pursued in countries other than Sweden. Applicants must establish contact with a Swedish University willing to accept the applicant for the proposed studies. Initial requests for application forms must be made in writing, and should include the applicant's name and address, nationality, educational background, work experience, knowledge of any languages, statement of the purpose of the study or research in Sweden, and a copy of a letter of invitation from a Swedish University Department. Applications are available from the Swedish Institute, Department for Exchanges in Education and Research, PO Box 7434, SE-103 91, Stockholm, Sweden. Email grantinfo@si.se. Homepage: http://www.si.se. Requests for application forms must reach the Swedish Institute before 1 December.

Swiss Government Scholarships (L)

- Tuition fees, living allowance, medical insurance and assistance with airfares
- 1 academic year

One scholarship is available for art/music and two for other disciplines, to undertake postgraduate study or attend an art school/conservatory in Switzerland. Applicants will be required to pass a language test in German or French. Applicants must be aged under 35. Applications close early October.

The Turkish Government Language & Culture and Higher Education Scholarships (I,L)

Scholarships are available to high school graduates to undertake study at a Turkish University. Students may be required to undertake a one year Turkish language course before commencement of the degree. The scholarships pay a monthly allowance for the duration of the course. Scholarships are also available to university graduates who would like to attend Turkish Language and Culture Summer Courses conducted by the Turkish Studies Centre. Further information is available from the Embassy of the Republic of Turkey, 60 Mugga Way, Red Hill ACT 2603. Applications close 30 May for Language and Culture Scholarships, and 15 July for Higher Education Scholarships.

Yokoyama Scholarship Awards (L)

Assistance may be available for undergraduate and postgraduate study at a Japanese University.

Information is available from Mr Masao Iwashita, Secretary-General, Yokoyama Scholarship Foundation, 6F Shiozaki Building, 2-7-1 Hirakawacho, Chiyoda-Ku, Tokyo 102 Japan, Tel (813) 3238 2913, Fax (813) 5275 1677.

Faculty Travel

Faculty of Engineering

Engineering @ UNSW Exchange Scholarships (L)

Applicants for The UNSW International Exchange Travel Scholarships administered by the International Student Centre will be considered for these awards. There is no separate application form.

Top-Up Engineering @ UNSW Exchange Scholarships

- $500

Students undertaking an undergraduate degree in the Faculty of Engineering who are offered an International Exchange Travel Scholarship will also be offered the Top-Up Scholarship.

Engineering @ UNSW Exchange Scholarships

- $1,500

Students undertaking an undergraduate degree in the Faculty of Engineering who were unsuccessful in their application for an International Exchange Travel Scholarship may be eligible for an Engineering @ UNSW Exchange Scholarship. Selection will be based on the application for the International Exchange Travel Scholarship and academic merit.

Mechanical and Manufacturing Engineering

The NSK Silver Jubilee Scholarship for Study in Japan (L)

- Up to $15,000 for study in Japan
- From 3-6 months

The scholarship is open to undergraduate or postgraduate students in the School of Mechanical and Manufacturing Engineering at UNSW, whose thesis projects would be enhanced by work in a Japanese organisation in Japan. The scholarship may cover expenses related to a three to six month stay in Japan. Students should use the stay to work on their thesis project with Japanese universities and industry or government research bodies etc. The scholarship is awarded on the basis of academic merit, a demonstrated interest in Japan and an assessment of the progress of the project. Information is available from Professor B.E. Milton, Head of School, Mechanical and Manufacturing Engineering, Tel (02) 9385 4088, Fax (02) 9663 1222, Email: B.Milton@unsw.edu.au. Applications normally close at the end of each year.

Vacation Scholarships

Some Schools may offer scholarships for the long vacation period from December to February each year. Students should contact the relevant School office for information.

General Vacation

The Australian Kidney Foundation Summer Vacation Scholarships (I,L)

- Up to $900
- 6 to 8 weeks

The scholarships are open to undergraduate students who have completed at least one year of full-time study in Medicine or a course related to Biological Science. The proposed research project must be related to the kidney and the urinary tract, and carried out at a university department during the summer vacation period. Applications are available from the Medical Director's Office, Australian Kidney Foundation, GPO Box 9993, Adelaide SA 5001, Tel (08) 8267 4555, Fax (08) 8267 4450, Email: ttaylor@terra.net.au. Applications close 15 September.

ANU Summer Research Scholarships (I,L)

- $130 per week, plus full board and travel
- 8-12 weeks

Scholarships are offered to undergraduate students for short research projects in Physics, Chemistry, Astronomy, Biological Sciences, Computer Sciences, Engineering, Medical Sciences, Earth Sciences, Pacific and Asian Studies, Social Sciences and Environmental Sciences, at the Institute of Advanced Studies, ANU. Further information and applications are available from Anna Weidemann, Summer Research Scholarship Program, The Australian National University, Canberra ACT 0200, Tel (02) 6249 4138, Fax (02) 6249 4891, Email: School.office.rsbs@anu.edu.au. Applications close late August.

Cooperative Research Centre for Food Industry Innovation Vacation Scholarships (I,L)

- Up to $2000
- 8 to 12 weeks between November and March

The scholarships are open to final year undergraduate students enrolled in courses in one or more of the following disciplines: biochemistry, biotechnology, bioprocess engineering, chemistry, food science, food technology, immunology, microbiology, or molecular biology. Research projects must be related to one of the research programs of the CRC. Application Kits are available from September, and further information is available from Ms M Romeo, Education Officer, CRC for Food Industry Innovation, c/- Department of Biotechnology, UNSW, Sydney NSW 2052, Tel (02) 9385 1298, Fax (02) 9385 1015, Email m.romeo@unsw.edu.au. Applications close early October.

The CSIRO Division of Marine Research Vacation Scholarships (I,L)

- Up to $450 per week plus travel expenses
- 8 weeks between December and February

Applicants must be full-time undergraduate students who have completed not less than three years of their course. Research projects will be undertaken with the CSIRO Division of Marine Research at either Hobart, Cleveland or Marmion. Applications close early September.

The CSIRO Vacation Scholarships (I,L)

- $420 per week
- 8 to 12 weeks between December and February

The scholarships are open to postgraduate and undergraduate students who have completed no less than three years of a full-time course in Physics, Mathematics, Computer Science, Electrical Engineering, or a closely allied subject. Research projects are carried out under the individual supervision of a research engineer or scientist. Applications are available on the web at http://www.atnf.csiro.au/educate/summer_vacation.html. Applications close early August.

The Dried Fruits Research and Development Council (DFRDC) Studentships (I,L)

- Up to $3,000 for Studentships, up to $1,000 for Student Awards

The Studentships assist students to undertake research projects during the summer vacation period. Further information and applications are available from the Executive Officer, Dried Fruits Research and Development Council, Box 1142, Mildura Vic 3502, Tel (050) 221515, Fax (050) 233321. Applications close 15 October.

The Heart Foundation Vacation Scholarships

Scholarships are available during the long vacation period for research projects related to cardiovascular function and disease. Applicants should normally have completed at least two years of an appropriate degree course in the biological sciences. Preference will be given to applicants who have had little or no laboratory experience. Applications close early September.

Medical School Vacation Scholarship Scheme - John Flynn Scholarships

- $2,500 pa to cover travel, accommodation, mentor's honorarium, host practice costs, student stipend
- Two weeks per year for up to four years

Scholarships are available to undergraduate medical students to take up vacation placements in rural and remote communities, country towns or regional centres. Placements may be with a general practitioner, rural hospital, rural/remote Aboriginal Medical Service, or a combination of these. Further information may be obtained by telephoning 1800 801 454.

The National Multiple Sclerosis Society of Australia Summer Vacation Scholarships (L)

- $200 per week
- 6 to 8 weeks between November and March

The scholarships are open to undergraduate students completing three or four years of a full-time course leading to an honours degree in medicine, science, or the biological or health sciences. Research projects must be relevant to multiple sclerosis and carried out at a university department during the summer vacation period. Applications close mid-August.

The Novo Nordisk Student Research Scholarship (I,L)

- $1,000 to $1,500
- 6 to 9 weeks over the vacation period

The scholarship is available for diabetes-related research at the Department of Endocrinology, Prince of Wales Hospital and is open to students enrolled at any tertiary institution in Australia. Preference will, however, be given to students enrolled in an undergraduate degree in Science or Medicine at UNSW. Selection will be based on interest in research in diabetes mellitus and academic performance. Further information is available from Associate Professor Bernie Tuch, Prince of Wales Hospital, Tel (02) 9382 4814. Applications close 31 October.

Faculty Vacation

Faculty of Engineering

Computer Science and Engineering

The Computer Science and Engineering Vacation Scholarships (I,L)

- Up to $3,600
- 12 weeks

Vacation scholarships are available to students in the School of Computer Science and Engineering who intend to pursue Honours or postgraduate study. Further information is available from the School of Computer Science and Engineering, UNSW, Tel (02) 9385 4329.

Postgraduate Scholarships

Following are details of scholarships available to postgraduate students at UNSW. The scholarships are listed by Faculty and course (e.g. scholarships in Science and Technology or Engineering) or whether they are available to undertake travel. If students from more than one Faculty are able to apply the scholarship is listed in the General Scholarships section.

For further information contact:

The Scholarships and Student Loans Unit
The University of New South Wales
Sydney 2052 Australia

Tel (02) 9385 3100/3101/1462
Fax (02) 9385 3732
Email: scholarships@unsw.edu.au
Website: http://www.infonet.unsw.edu.au/academic/schopriz/httoc.htm

General

Main programs of assistance for postgraduate study

The Australian Postgraduate Awards (APA) (L,R)

- $15,888 pa (1998 rate). Other allowances may also be paid.
- Up to 2 years for a Masters by Research, 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. Students with Permanent Resident status should normally have lived in Australia continuously for 12 months. Applications close 31 October.

The Australian Development Scholarships (ADS) (I)

- Tuition fees, medical cover, airfare and a stipend.
- Duration of the course

This award is for international students from selected countries only. Information and applications can only be obtained from Australian Diplomatic Posts or Australian Education Centres in the home country. Applications normally close at least 12 months before the year of study.

The Overseas Postgraduate Research Scholarships (OPRS) (I,R)

- Tuition fees and medical cover only
- 2 years for a Masters by Research, 3 years for a PhD degree

Eligibility is confined to postgraduate research students who are citizens of countries other than Australia or New Zealand. Applications close 30 September.

Other General

Aboriginal and Torres Strait Islander Researchers Development Program (L,R)

- At least $3,000
- Up to 3 years

The Scholarships are awarded to support research projects by Aboriginal and Torres Strait Islander researchers in the biological, mathematical, physical, chemical, engineering, earth and applied sciences and the humanities and social sciences, which are likely to lead to a significant conceptual advance in understanding of a subject or lead to the solution of an important practical problem. Further information and applications are available from the Research Office, UNSW, Tel (02) 9385 1074 or the Research Office website: http://www.ro.unsw.edu.au. Applications close mid-June.

The Anthony Rothe Scholarship (I,L,R)

- $28,000 pa plus allowances
- Up to 3 years

Applications are open to postgraduate students proposing to undertake a PhD in a field related to the causes, prevention, treatment or cure of leukaemia and allied blood disorders. Information and applications are available from The Secretary, Anthony Rothe Memorial Trust, c/- Brigden & Partners, GPO Box 2564, Sydney NSW 2001. Applications close late August.

The Apex Foundation for Research Into Intellectual Disability Research Grants (I,L,R)

Grants may be awarded for new or existing research projects in any discipline concerned with the causes, diagnosis, prevention or treatment of intellectual disability and allied conditions. Applications can be obtained from the Hon. Secretary, Apex Foundation for Research into

Intellectual Disability Limited, PO Box 311, Mount Evelyn VIC 3796. Applications close late July.

The Arthritis Foundation of Australia Research & Professional Education Awards (L,R)

- $5,000 - $32,000 pa
- 1 to 3 years

Scholarships, fellowships and grants are available to support research projects into arthritis, osteoporosis and other muskuloskeletal disorders. Applicants must be enrolled in studies leading to a Masters by Research or PhD. Further information and applications are available from The Arthritis Foundation of Australia, GPO Box 121, Sydney NSW 2001, Tel (02) 9552 6085, Fax (02) 9552 6078. Applications close early June.

The Asthma Foundation of New South Wales Research Scholarships (I,L,R)

- To be determined
- 1 to 3 years

The scholarships are available for research into asthma including the basic medical serVices or clinical and psychological investigations. Further information is available from The Asthma Foundation of NSW, Unit 1 "Garden Mews", 82-86 Pacific Highway, St Leonards NSW 2065. Applications close in early August.

The Australian Brewers Foundation Alcohol Related Medical Research Postgraduate Scholarships (I,L,R)

- Similar to the NHMRC (see NHMRC entry)
- 1 year

Similar to the NHMRC. The scholarships are available to support research into the medical, social and public health aspects of moderate, hazardous or harmful alcohol consumption. Information and applications are available from ABF-Medical Research Advisory Committee, Tel (02) 9552 6688, Fax (02) 9552 1369. Applications close mid-September.

The Australian Coral Reef Society (ACRS) Inc Student Grants (I,L,R,C)

- $1,000 (plus $1,500 Walker prize for the best proposal)

The grant is open to students who are enrolled at an Australian University in a PhD or MSc involving research on coral reefs. Recipients must be a member of, or willing to join the ACRS. Applications normally close late November.

Australian Food Industry Science Centre (AFISC) Scholarships (I,L,R)

- $25,000 pa plus allowances
- Up to 2 years for a Masters by Research, 3 years for a PhD

It is expected that applicants will be of Honours 1 or high 2A standard or equivalent. Graduates from non-food technology disciplines, such as engineering, mathematics and physics, are also encouraged to apply. Further information and applications are available from AFISC, Private Bag 16, Sneydes Road, Werribee VIC 3030, Tel(03) 9742 0111. Applications close early November.

The Australian Federation of University Women (I,L,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, 215 Clarence Street, Sydney NSW 2000, Tel (02) 9299 9888.

The Australian Institute of Nuclear Science and Engineering (AINSE) Postgraduate Research Awards (I,L,R)

- $7,500 supplement to an APA or equivalent scholarship and $5,500 pa for facility costs plus allowances
- Up to 3 years

The Institute offers awards for postgraduate students whose research projects are associated with nuclear science or its applications. Applicants must be eligible for an APA or equivalent scholarship after having completed a Bachelor of Engineering or Bachelor of Science with Honours. At least one month per year must be spent at the Institute at Lucas Heights, NSW. Applications close early December.

The Australian Kidney Foundation Grants and Scholarships (I,L,R)

The AKF supports research into the causes, prevention and treatment of disorders of the kidneys and urinary tract. Programs include Medical Research Seeding Grants, Medical Research Equipment Grants, Biomedical Research Scholarships and Summer Vacation Scholarships. Applications are available from the Medical Director's Office, Australian Kidney Foundation, GPO Box 9993, Adelaide SA 5001, Tel (08) 8267 4555, Fax (08) 8267 4450, Email: ttaylor@terra.net.au. Applications close 30 June.

The Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART) Student Award (I,L,R,C)

- $1,000 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. The award is offered bi-annually. Applications close early November.

The Australian Society for Microbiology (L,R,C)

- $100 - $10,000

The Australian Society for Microbiology (ASM) provides prizes and awards, for study, research and projects related to Microbiology. More information can be obtained from the ASM National Office, Unit 23/20 Commercial Rd, Melbourne VIC 3004, Tel (03) 9867 8699, Fax (03) 9867 8699.

The Australian Spinal Research Foundation Postgraduate Research Awards (I,L,R)

- Equivalent to Australian Postgraduate Award (see APA entry under General)
- Up to 2 years for a Masters by Research or 3 years for a PhD degree

Applicants must be undertaking a Masters by Research or PhD in an area designed to contribute to an understanding of the anatomical and physiological mechanisms underlying chiropractic care or the clinical efficiency of chiropractic care and management procedures. Information and applications are available from the Australian Spinal Research Foundation, PO Box 1047, Springwood Qld 4127, Tel (07) 3808 4098, Fax (07) 3808 8109, Email: t.flack@qut.edu.au. Applications close mid-October.

The Captain Reg Saunders Scholarship (L,R,C)

- $3,000
- Up to 4 years

Applicants must be Aboriginals or Torres Strait Islanders eligible to commence a university degree in the area of psychology, nursing, applied science, social work or education. Further information and applications are available from the Aboriginal Education Program, UNSW, Tel (02) 9385 3805.

The Community Health and Anti-Tuberculosis Association - The Harry Windsor Biomedical and Medical Research Scholarship (L,R)

- $23,630 pa (Medical postgraduates), $15,888 (Biomedical Science graduates) plus allowances
- Up to 3 years

Applicants must be proposing to undertake full-time postgraduate medical research in the areas of tuberculosis, respiratory disease (particularly community aspects) or the health of disadvantaged people. Only original application forms will be accepted and are available from The Executive Officer, Community Health and Anti-Tuberculosis Association, PO Box 200, Rose Bay, NSW 2029, Fax (02) 9371 9768. Applications close 1 August.

The Cooperative Research Centre for Eye Research and Technology (CRCERT) Postgraduate Research Scholarship (I,L,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. For information about application procedures applicants should initially contact Dr Mark Wilcox, CRCERT, University of New South Wales, Sydney 2052, Tel (02) 9385 0222.

The Clean Air Society of Australia and New Zealand Inc Postgraduate Research Award (I,L,R,C)

- $5,000 pa
- 1 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 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 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 and Student Loans Unit or DRDC, Level 3, 84 William Street, Melbourne VIC 3000, Tel (03) 9602 5300. Applications close 31 October.

The Forest and Wood Products Research and Development Corporation (FWPRDC) Scholarships (L,R)

- Up to $25,000 pa
- Up to 3 years

The scholarships are open to students undertaking a postgraduate research degree at an Australian University. Selection is based on academic merit and the relevance of the project to FPWRDC Programs. Further information and applications are available from the Executive Director, FWPRDC, PO Box 157, Bond University Qld 4229, Fax (07) 5578 7911. Applications close early October.

The Garnett Passe and Rodney Williams Memorial Foundation Research Scholarships in Otolaryngology (I,L,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 (I,L,R,C)

- Up to $5,000 for a specific research project

Grants-In-Aid are 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 late July.

The Gowrie Scholarship Trust Fund (L,R)

- $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 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 mid-October.

The Great Barrier Reef Marine Park Authority Research Support (I,L,R)

- $1,500

Applicants must be undertaking a full-time 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 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 early April.

The Julian Small Foundation Annual Research Grant (I,L,R)

- Up to $5,000

Applications are open to postgraduate and undergraduate students undertaking research and involved in the study of law, or industrial relations. Selection will be based on a research proposal which outlines how the research will advance thinking and practice in the area of employment law and industrial relations in Australia. Applications close mid-August.

The June Opie Fellowship (I,L,R,C)

- NZD$12,000
- 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 late October.

Land and Water Resources Research and Development Corporation (LWRRDC) Postgraduate Research Scholarships (I,L,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 in Australia. Applications are available from the Scholarships and Student Loans Unit or LWRRDC, GPO Box 2182, Canberra ACT 2601, Tel (02) 62573379. Applications close early October.

The Lionel Murphy Postgraduate Scholarship (L,R,C)

- $15,000 pa for study in Australia, up to $30,000 for study overseas
- 1 year

Applicants must be intending to undertake a postgraduate degree in Law, Science, Legal Studies or other appropriate discipline. Preference will be given to applicants who propose to study the law and legal system in a social context, science/law or international law. Information and application forms are available from the Lionel Murphy Foundation, GPO Box 4545, Sydney NSW 2001, Tel (02) 9223 5151, Fax (02) 9223 5267. Applications close mid-September.

The MBF Health Research Awards-Postgraduate Research Scholarships

- Similar to NHMRC guidelines

The scholarships are open to students undertaking an MD or PhD in the areas of preventative health care, disease/drug management, evaluation of health care delivery outcomes, health policy evaluation and public health promotion/communication. Applications are available from The Executive Assistant, Research Team, Medical Benefits Fund of Australia Ltd, 97-99 Bathurst St, Sydney NSW 2000. Tel (02) 9323 9158. Fax (02) 9323 9168. Applications close late February.

The Meat and Livestock Australia (MLA) Studentships and Junior Research Fellowships (L,R,C)

- $15,888 pa for study in a Masters or Diploma, $20,000 for a PhD in Australia or US$17,500 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 in disciplines relevant to the meat and livestock industry. Applications normally close late September.

The Menzies Research Scholarship in 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. Applicants should be full-time students, who have completed the first stage of a PhD program. Applications are available from The Menzies Foundation, 210 Clarendon St, East Melbourne VIC 3002, Fax (03) 9417 7049. Applications close late June.

The Minerals Council of Australia Student Research Award (I,L,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 in mining. The award will be judged on a paper written for and presented at the Minerals Council of Australia's Environmental Workshop. Nominations close early May.

The National Health and Medical Research Council (NHMRC) Training Scholarship for Aboriginal Health Research (L,R)

- $15,888 - $23,630 pa (depending on qualifications)
- Up to 3 years

Applicants must be undertaking an undergraduate or postgraduate degree which includes, or leads to, research relevant to Aboriginal health. Applications will be assessed in terms of previous qualifications and experience. Consideration will be given to prior knowledge and experience of Aboriginal culture and health. Applications close early August.

The National Health and Medical Research Council (NHMRC) Dora Lush Biomedical Postgraduate Scholarships (L,R)

- $15,888 pa, $20,503 for HIV/AIDS research, $17,888 for special initiative scholars, plus allowances
- Up to 3 years

Applicants must have completed a Science degree with Honours, or equivalent, at the time of submission of the application. Current APA holders or students enrolled in the final year of an Honours degree at the time of application are not eligible. Applications close early August.

The National Health and Medical Research Council (NHMRC) Medical and Dental Postgraduate Scholarships (L,R)

- $23,630 pa plus allowances
- Up to 3 years

The scholarships are open to medical and dental graduates to undertake full-time research. Applications are particularly encouraged for research in the following special initiative areas: Aboriginal health and disease, prostate cancer, alcohol and substance abuse, nursing and allied health serVices, dementia, schizophrenia, injury and HIV/AIDS. Applications close early August.

The National Health and Medical Research Council (NHMRC) Public Health Postgraduate Scholarships (L,R)

- $23,630 pa (medical/dental graduates), $15,888 pa (other graduates), $20,503 pa for HIV/AIDS research, $17,888 pa for special incentive scholars, plus allowances
- Up to 3 years

The scholarships are open to medical/dental or health related graduates to obtain training in public health research. Applications are particularly encouraged for research in the following special initiative areas: Aboriginal health and disease, prostate cancer, alcohol and substance abuse, nursing and allied health serVices, dementia, schizophrenia, injury and HIV/AIDS. Applications close early August.

The National Heart Foundation of Australia Postgraduate Medical and Science Research Scholarships (L,R)

- $17,637 pa (science), $23,257 pa (medical) plus $1,200 departmental allowance
- Up to 3 years subject to satisfactory progress

Scholarships are available to science or medical graduates for research in cardiovascular function, disease or related problems. Applicants must usually reside in Australia. Further information and applications are available from the Medical Director, National Heart Foundation, PO Box 2, Woden ACT 2606. Medical applications close in May and Science applications close in October.

The National Tertiary Education Union (NTEU) Scholarship for the Study of Industrial Relations and Unionism in Australian Tertiary Education (I,L,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. Further information is available from NTEU, PO Box 1323, South Melbourne VIC 3205, Tel (03) 9254 1910. Applications close early November.

The National Multiple Sclerosis Society of Australia Postgraduate Research Scholarships (L,R)

- Same as NHMRC 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 mid-July.

The NSW Ministry for the Arts Scholarships (L)

- $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 the 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 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 mid-December.

The Postgraduate Equity Scholarships (L,C)

- Substitution of HECS for tuition fees
- Duration of the course if eligibility criteria continue to be satisfied

These scholarships allow postgraduate students enrolled in full-fee courses to pay HECS for their course rather than course fees. Students granted the scholarship must still pay Student Activity Fees. Students who have previously completed a postgraduate course in Australia at the same or higher level are not eligible. Applications for Session One close 30 January. Applications for Session Two close 15 July.

Financial Need HECS Substitution Scholarships
Applicants must be in receipt of a full allowance from the Department of Social Security (DSS), Department of Veteran Affairs, or AUSTUDY.

HECS Substitution for Scholarships for Women
A limited number of scholarships are provided to women enrolling in postgraduate courses after a period of absence

from study and/or employment who are seeking to extend their professional experience in order to re-enter the workforce. Preference will be given to women enrolling in courses which have a low female enrolment. Selection will take into account the applicant's academic merit, her personal statement, including details of a well-planned future career path, and referee's support. The scholarship is tenable for the duration of the course.

The Re-Entry Scholarship for Women (I,L,R,C)

- $15,888 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 of 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 letter of application and curriculum vitae should be forwarded to the Scholarships and Student Loans Unit, UNSW. Applications close 31 October.

The River Basin Management Society Ernest Jackson Memorial Research Grants (I,L,R)

- Up to $2,000

The scholarship assists PhD and Masters students undertaking research in the field of river basin management. PhD, Masters and 4th year Honours students are encouraged to apply. Further information is available from RBMS, PO Box 113, Forest Hill Vic 3131, Tel (03) 9816 6896. Applications close in April.

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 APA or equivalent university postgraduate award. Applicants may be proposing study in qualifications in economics, commerce or arts. 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, Email: lance@creativeaccess.com.au. Applications close in late October.

The RSPCA Alan White Scholarship (I,L,R)

- $2,500

Applicants should be undertaking original research to improve the understanding and welfare of animals. Applicants must have a sound academic record and demonstrate a major commitment animal welfare issues. A letter of application including two referees and academic transcripts, should be sent to the Executive Officer, RSPCA Australia, PO Box E369, Queen Victoria Terrace, Canberra ACT 2600, Tel (02) 62311437. Applications close mid-March.

The Rural Allied Health Placement Grants (L,R)

- Up to $500

Grants are available to students undertaking a postgraduate course in dietetics or psychology (Masters). Applications are available from the NSW Health Rural Health Support Unit, Tel (02) 6640 2302, Fax (02) 6640 2499, Email rhsu@nor.com.au, web: www.nor.com.au/community/rhsu. Session One applications close 15 May. Session Two closing dates are available in August.

The Rural Allied Health Scholarships (L)

- $5,750

Scholarships are available to students in any year of a postgraduate course in dietetics or psychology (Masters). Applications are available from the NSW Health Rural Health Support Unit. Tel (02) 6640 2302, Fax (02) 6640 2499, Email rhsu@nor.com.au, web: www.nor.com.au/community/rhsu. Applications close late September.

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 Social Policy Research Centre (SPRC) Postgraduate Research Scholarship (L,R)

- $15,888 pa (equivalent to the APA), plus allowances
- 3 years for a PhD

Applicants should hold 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 Administrator, Social Policy Research Centre, UNSW, Tel (02) 9385 3833. Applications close late November.

The State Librarian's Metcalfe Scholarship at UNSW (L,R,C)

- At least $2,000

The scholarship is open to suitably qualified applicants to undertake a Masters or PhD in the areas of librarianship, marketing or technology. Selection will be based on academic merit, the 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. Applicants should hold an Honours degree or equivalent and have a strong motivation to make a professional career in the sugar industry. Further information and applications are available from the Executive Director, Sugar Research and Development Corporation, PO Box 12050, Brisbane Elizabeth St Qld 4002, Tel (07) 3210 0495, Fax (07) 3210 0506. Applications close mid-September.

The Sydney Gay and Lesbian Business Association Scholarship (L, R, C)

- $1,500
- 1 year

The scholarship is provided to encourage the participation of gay men and lesbians in business and management careers. Scholarships are available to full-time students in Commerce or the AGSM. Applicants must be gay or lesbian. Applications normally close 15 April.

The Telstra Research Laboratories Postgraduate Research Fellowship (L,R)

University departments may apply for the Fellowships for one or more of their PhD students who are undertaking research relevant to the telecommunications industry in the fields of electrical engineering, computer science, science, psychology, social science or economics or other appropriate course. Further information is available from the Fellowship Applications Officer, Telstra Research Laboratories, Box 249, Rosebank MDC, Clayton Victoria 3169. Email: c.zaman@trl.telstra.com.au. Applications close late September.

United Uranium Trust Fund Scholarship

This Scholarship is available for the study of nuclear science and technology at the Australian Nuclear Science and Technology Organisation (ANSTO) or other designated institution. Applicants must be under 40 years of age. Further information and applications are available from ANSTO on telephone (02) 9543 3111.

VSDC Deafness Projects (L)

Tertiary Education Scholarships may be awarded to deaf students undertaking tertiary courses related to deafness, deaf education, or fields which will advance the interests of deaf people. Applicants must be Permanent Residents of Australia. Further information is available from the VSDC-SerVices for Deaf Children, PO Box 6466, St Kilda Rd Central, Melbourne Vic 3004. Applications close mid-May.

The Wenkart Foundation Grants (L,R)

- Up to $22,000 pa
- 2 years with the possibility of renewal

Applicants must be undertaking full-time research in clinical, biomedical or health related clinical sciences. The grants will not be available again until the 1999 academic year. Applications close mid-May.

The Zonta International Amelia Earhart Awards (I,L,R)

- US$6,000
- 1 year

Applicants must be women who have completed one year graduate study in an aero-space related science or engineering degree. Further information and applications are available from Zonta International, 557 West Randolph St, Chicago, Illinois 60661-2206, USA, Tel +1 312 930 5848, Fax +1 312 930 0951. Applications close early November.

Faculty

Faculty of Engineering

The CRC for Waste Management and Pollution Control Research Scholarships (I,L)

- Up to $22,000 pa or $6,000 pa top-up, plus allowances
- Up to 3 years

Several scholarships are available for students to undertake ME or PhD research in waste management and pollution control. Applicants should hold a relevant degree with at least Honours 2/1 (or equivalent). Interested applicants should contact Dr J.S. Nielsen, Tel (02) 9385 5796.

The Faculty of Engineering Research Scholarships (L,R)

- $15,888 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 6429, Fax (02) 9385 5456.

The Supplementary Engineering Postgraduate Awards (I,L,R)

- $8,000 pa (taxable) supplement to an APA, APA(I), OPRS or Faculty Award

The awards may be available to full-time students who are in receipt of an APA, APA(I), OPRS, or Faculty Award and who are undertaking internal PhD studies in the Faculty of Engineering at UNSW. Recipients will be required to undertake up to six hours per week (up to a total of 180 hours for the year) of teaching and/or research assistance.

The Women in Engineering Research Scholarship (L,R)

- $15,888 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 and Environmental Engineering, Chemical Engineering and Industrial Chemistry, Computer Science and Engineering, Electrical Engineering and Telecommunications, Geomatic Engineering, Mechanical and Manufacturing Engineering, Mining Engineering, Petroleum 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 6429, Fax (02) 9385 5456. Applications close 31 October.

Travel Scholarships

Students in receipt of postgraduate scholarships not listed below may, if the scholarships conditions allow, spend a period of time overseas undertaking research relevant to their Australian qualification.

General Travel

AAUW Educational Foundation Awards (I,L,R,C)

The American Association of University Women (AAUW) offers a range of scholarships and fellowships for full-time study in the United States. Additional information may be obtained from the Association's website: http://www.aauw.org

AAUW Educational Foundation International Fellowships (I,L,R,C)

- US$16,000
- 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. Applicants can be preparing to undertake study in a broad range of disciplines including arts and humanities, physical and biological sciences, social sciences, law, economics, political sciences, or studies important to changing the lives of women and girls. International fellows can also qualify for a supplemental grant (US$5,000-$7,000) to support a community action project designed to improve the lives of women and girls for study in the fellow's home country in the year immediately following the fellowship year. Application packs are available from the AAUW Educational Foundation, Customer Centre, Dept 141, N. Dodge St, Iowa City, IA 52243-4030 USA. Applications close mid-January for the Fellowship year commencing in July.

The ACSANZ Postgraduate Awards for Canadian Studies (I,L,R)

- Up to $2,800 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 a Masters or Doctoral degree at an Australian or New Zealand university. 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. Information and applications are available from the Academic Relations Officer, Canadian High Commission, Commonwealth Avenue, Canberra, ACT 2600, Tel (02) 6273 3844, Fax (02) 6270 4083, Email co.cnbra@cnbra01.x400.gc.ca. Applications close late September.

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 mid-June.

The Association of International Education Japan (AIEJ) Short-Term Student Exchange Promotion Program (Inbound) Scholarships (I,L,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 (I,L,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.

Association of University Women Educational Foundation-Charles & June Ross International Fellowship (L,R,C)

- US$15,400
- 1 year

The fellowship is available to Australian women who have graduated from an Australian University and who are proposing to undertake one year of full-time postgraduate study or research in the United States. Applicants must be members of the Australian Federation of University Women or AAUW and intend to return to Australia to pursue their professional career. Information and applications are available only from AAUW Educational Foundation, PO Box 4030, Iowa City, Iowa 52243-4030, USA, Tel +1 319 337 1716, Fax +1 319 337 2201. Applications close late November.

The AT&T Leadership Award (I,L,R,C)

- US$5,000

The award is open to students who will be commencing full-time undergraduate or postgraduate study in the United States between January and September in the year of application. The scholarship is open to students from the following Asia/Pacific countries: Australia, China, Hong Kong, India, Indonesia, Japan, Republic of Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand. Information and applications are available from the U.S. Consulate General, USIS, Level 59 MLC Centre, 19-20 Martin Place, Sydney NSW 2000, Tel (02) 9662 3016. Applications close 15 September.

The Australian Academy of Science International Exchange Programs (L,R)

The Academy administers exchange programs which support collaborative research between professional Australian scientists and technologists with countries such as the UK, France, Germany, Taiwan, China, Korea and Japan. The programs provide funds for living and travelling costs. Applicants must be Australian citizens who hold a PhD degree or equivalent. Information is available from International Programs, The Australian Academy of Science, fax (02) 6257 4620, Email: is@scince.org.au, web site: http://www.science.org.au/internat/exchange/contscix.htm.

The Australia-Korea Foundation Awards (L,R,C)

The AKF provides assistance to Korean language graduates who will be undertaking teacher training in the Korean language, or for work-experience programs. Information and applications are available from the Programs Co-ordinator, National Korean Studies Centre, PO Box 218, Hawthorn Vic 3122. Email: nksc@swin.edu.au.

The Australian Bicentennial Scholarships and Fellowships Scheme (L,R,C)

- £4,000 sterling
- At least 3 months

Awards are available for study or research in the United Kingdom in any discipline, where it can be demonstrated that there is an advantage to be gained from a period of study in the U.K. Applicants must be enrolled as postgraduate students at an Australian higher education institution and who are usually resident in Australia. Applications are available from the Secretary, Sir Robert Menzies Centre for Australian Studies, University of London, 28 Russell Square, London, WC1B 5DS, UK, Tel +44 171 580 5876, Fax +44 171 580 9627, Email mcintyre@sas.ac.uk. Applications close early November.

The Australian Federation of University Women (AFUW) (I,L,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, 215 Clarence St, Sydney NSW 2000, Tel (02) 9299 9888.

The British Aerospace Australia Chevening Scholarship (L,R,C)

- Tuition fees, maintenance allowance, airfare
- 1 year

The scholarship is available for study in an approved, one-year MSc course in aerospace engineering at a British university. 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 British Chevening Scholarships (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.

British Council Postgraduate Bursaries (L,R)

- Return economy airfare plus monthly stipend of £450
- 3 months

The scholarships are available for students enrolled in a full-time PhD who are proposing to spend three months at

a British University or similar institution to take advantage of British expertise, equipment or data. Applications should be received by the British Council a minimum of 6 months prior to departure. Further information and applications are available from the British Council, PO Box 88, Edgecliff NSW 2027, Tel 9326 2022, Fax 9327 4868.

The Cambridge Commonwealth Trust Scholarships (L,R,C)

The Cambridge Commonwealth Trust administers several scholarships for Australian Citizens to undertake postgraduate study at the University of Cambridge. Scholarship application forms should be requested from the University of Cambridge when applying for admission. Admission forms and copies of the Graduate Studies Prospectus are available from The Board of Graduate Studies, 4 Mill Lane, Cambridge CB2 1RZ, United Kingdom. By submitting one Scholarship Application Form, applicants will be considered for all the Trust's scholarships for which they are eligible. Information on how to apply is available from the Honorary Secretary, Australian Committee of the Cambridge Australia Trust, GPO Box 93, Canberra ACT 2601, Tel (02) 6248 7744, Fax (02) 6248 6287. Applications for admission to Cambridge close 31 January and scholarship applications close 30 April in the following year.

The Cancer Research Fellowship Programme (I,L,R)

- Travel expenses and living allowances
- 1 year

Applicants should be engaged in research in medicine or the 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.

Churchill Fellowships (L)

- Tuition, travel and living allowances

Churchill Fellowships provide financial support for Australian Citizens to undertake study, training or projects overseas. Fellowships will not normally be awarded for higher academic or formal qualifications however. Applicants must be over 18 years of age. Further information and applications are available from the Chief Executive Officer, The Winston Churchill Memorial Trust, 218 Northbourne Ave, Braddon ACT 2612, Tel (02) 6247 8333. Applications close late February.

The Commonwealth Scholarship and Fellowship Plan (CSFP) (L,R,C)

- Varies for each country. Generally covers travel, living expenses, 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 hold an undergraduate degree. 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 not eligible). Further information and applications are available from the Fulbright Home Page, http://sunsite.anu.edu.au/education/fulbright, or by contacting the Program Officer, Australian-American Educational Foundation, GPO Box 1559, Canberra ACT 2601, Tel (02) 6247 9331, Email amanda@aaef.anu.edu.au. Applications close 30 September.

DAAD- The German Academic Exchange SerVice Scholarships (I,L,R,C)

Application forms and information (including closing dates) for the following scholarships are available from the Embassy of the Federal Republic of Germany, 119 Empire Circuit, Yarralumla, Canberra ACT 2600.

One-Year Scholarships

- Monthly allowance between DM1,000 and DM1,700, 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 DM1,700, 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 20 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)

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 a 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 (I,L,R,C)

- Accommodation, monthly stipend of US$600, tuition fees, health insurance plus allowances
- 12 months with a possible one year extension

The Fellowships are available for postgraduate study at the University of Hawaii, preferably at Masters level. Citizens of the United States and Asian or Pacific countries 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. Applications close early October.

The English-Speaking Union (NSW Branch) Scholarship (L,R,C)

- Up to $8,000

The scholarship assists graduates who, at the outset of their careers, are seeking to further their education overseas. The scholarship is open to Australian citizens living in NSW or the ACT, whose intention it is to return to Australia after undertaking study overseas. Further information is available from The English-Speaking Union (NSW Branch), PO Box A2156, Sydney South NSW 1235, Tel (02) 9231 0667. Applications close early June.

Frank Knox Memorial Fellowships (L,R,C)

- US$15,000 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 Harvard University's graduate schools. Applications close early October.

The Fulbright Postgraduate Student Awards (L,R)

- Up to $28,506, depending on the type of award, with the possibility of other allowances (eg return airfares and tuition fees)
- 1 year

Students planning to undertake an American higher degree or engage in research towards an Australian higher degree in any field can apply for the Fulbright Student Awards. Four other privately sponsored awards are available - The Engineering Award, The Aboriginal and Torres Strait Islander People Award, The Visual and Performing Arts Award, and The Tim Matthews Memorial Award in Statistics and Related Disciplines. Applicants must be Australian Citizens who have completed an Honours degree (or equivalent). Further information and applications are available from the Fulbright Home Page, http://sunsite.anu.edu.au/education/fulbright, or contact the Honorary Secretary, Fulbright NSW State Selection Committee, Research and Scholarships Office, University of Sydney NSW 2006, Tel (02) 9351 3877, Email: gab@reschols.usyd.edu.au. Applications close late September.

The Golda Meir Scholarship (I,L,R,C)

- Tuition (some allowances may be paid)
- 1 year

The Golda Meir scholarships are available to graduates who are wishing to pursue a course 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)

- $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. Special consideration may be given to cases of financial hardship. Applications close October.

Greek Government Scholarships (L,R,C)

- Tuition fees, monthly subsidy plus other allowances

Scholarships are available for undergraduate and postgraduate study in Greece. Applicants must be Australian citizens. Further information is available from the Embassy of Greece, 9 Turrana St, Yarralumla ACT 2600, Tel (02) 6273 3011. Applications normally close late March.

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 early September.

The Harkness Mid-Career Fellowships (L,R,C)

- Professional travel allowance
- 7-12 months

The Mid-career Fellowships are provided to support 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 early September.

The Italian Government Scholarships (L)

- 1 million Italian lira per month
- 2 to 24 months

Scholarships are open to Australian citizens to undertake research and language studies in Italy. Applicants must be aged under 35 years. Further information is available from the Italian Embassy, 12 Grey St, Deakin ACT 2600, Tel (02) 6273 3333, Fax (02) 6273 4223. Applications close early March.

The Japanese Government (Monbusho) Scholarships (L)

Scholarships are available to Australian Citizens for study in Japan for postgraduate research or five years of undergraduate study. Applicants must be willing to study the Japanese language and receive instruction in Japanese. Further information and applications are available from Monbusho Scholarships, Embassy of Japan, 112 Empire Circuit, Yarralumla ACT 2600, Tel (02) 6272 7268, Fax (02) 6273 1848. Applications close early July.

The Kobe Steel Postgraduate Scholarship (L,R,C)

- Maintenance allowance of at least £7,000 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 mid-October.

The Korean Government Scholarships (L)

- Tuition fees, living allowance, travel and other allowances
- Duration of course

Scholarships are available to Australian citizens for Masters or PhD study in Korea. Preference will be given to applicants with a knowledge of the Korean language. Information and applications are available from the Embassy of the Republic of Korea, 113 Empire Circuit, Yarralumla ACT 2600, Tel (02) 6273 3044, Fax (02) 6283 4839. Applications close early May.

The Lady Davis Fellowship Trust (I,L,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, Tel (03) 9272 5511. Applications normally close in November.

The Laporte Centenary Scholarship (L,R)

- Airfare, living allowance, tuition fees
- 3 to 6 months

The scholarship is tenable for postgraduate research in the United Kingdom. Candidates should be undertaking a postgraduate qualification in a science-based discipline, preferably in the practical application of special chemicals. Applications are available from the Secretary, Sir Robert Menzies Centre for Australian Studies, University of London, 28 Russell Square, London, WC1B 5DS, UK, Tel +44 171 580 5876, Fax +44 171 580 9627, Email: mcintyre@sas.ac.uk. Applications close early November.

Learn Arabic in Cairo Scholarship (I,L,R,C)

- Course fees, AU$70 per month living allowance
- 8 months

Scholarships are available to undertake the Arabic as a Foreign Language course in Cairo. Applications are available from the Embassy of the Republic of Egypt, 1 Darwin Avenue, Yarralumla ACT 2600, Tel (02) 6273 4437, Fax (02) 6273 4279. Applications close 1 July.

The Lionel Murphy Postgraduate Scholarship (L,R,C)

- $15,000 pa for study in Australia, up to $30,000 for study overseas
- 1 year

Applicants must be intending to undertake a postgraduate degree in Law, Science, Legal Studies or other appropriate discipline. Preference will be given to applicants who are proposing study of the law and legal system in a social context, science/law or international law. Information and

application forms are available from the Lionel Murphy Foundation, GPO Box 4545, Sydney NSW 2001, Tel (02) 9223 5151, Fax (02) 9223 5267. Applications close mid-September.

The Lloyd's Register of Shipping Chevening Scholarship (L,R,C)

- Tuition fees, maintenance allowance, airfare
- 1 year

Two scholarships are available to graduates with 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 and Livestock Australia (MLA) Studentships and Junior Research Fellowships (L,R,C)

- $15,888 pa for study in a Masters or Diploma, $20,000 for a PhD in Australia or US$17,500 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 in disciplines relevant to the Australian meat and livestock industry. Applications normally close in September.

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 2000, Tel (02) 223 5244. Applications normally close October.

Nanyang Technological University Singapore Research Scholarships (I,L,R)

- Tuition fees plus S$1,400-S$1,500 per month allowance
- 2 years for a Masters, 3 years for a PhD degree

Research scholarships are available to graduates with good Honours degrees to undertake postgraduate study. Information and application forms are available from The Registrar, Nanyang Technological University. Email: gleong@ntu.edu.sg, Fax: +65 7911604.

The NSW Ministry for the Arts Scholarships (L)

- $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 The 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 one 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 (02) 6247 5777, Fax (02) 6257 4620. Applications close mid-March.

Overseas Research Students Awards Scheme (United Kingdom) (I,L,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.

Queen's Trust Grants (L)

- Up to $15,000

The Queen's Trust provides grants to Australian Citizens aged 18-28 years, for the pursuit of excellence in their chosen fields. Support is provided for projects studying the advancement of Australian youth, development of community leadership and/or other skills which will be of benefit to Australia. Information and applications may be obtained from the Queen's Trust, Tel 1800 033 625. Applications close in late April.

The Rhodes Scholarship (L,R,C)

- Tuition fees, assistance with travel expenses, up to $17,500 allowance
- 2 years, with a possible one year extension

The scholarship is tenable for postgraduate study 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 and community spirit. Further information is available on the Rhodes home page http://www/usyd.edu.au/su/rhodes. Applications close 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 Harvard University graduate schools. 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 Chair, Board of Faculties, ANU, Canberra ACT 0200. Fax (02) 6248 5561, Email: lynne.colley@anu.edu.au. Applications close at the end of December.

Rotary Foundation Ambassadorial Scholarships (I,L)

The Rotary Foundation offers scholarships to study or train in another country where Rotary clubs are located. Applicants must have completed at least two years of a university or college course , or have completed high school and have been employed for at least two years. Applicants must also be Citizens of a country in which there is a Rotary club. Information regarding scholarship availability, closing dates and applications should be obtained from the applicant's local Rotary club.

The Russian Scholarships (L,R,C)

- Payment an allowance and medical cover

Scholarships are available to Australian citizens to undertake undergraduate or postgraduate study in journalism, law, economics, international relations or medicine in Russia. Applications normally close in May.

The Sir Charles Mackerras / Australia-Britain Society Music Scholarship (L)

- £8,000 sterling

The scholarship is open to an outstanding young conductor, composer or repetiteur, aged between 21 and 30 who is likely to be an influential leader in the field of music, to undertake study in the United Kingdom or the Czech republic for at least six months. Application forms are available from the British Council, PO Box 88, Edgecliff NSW 2027, Tel (02) 9326 2022, Fax (02) 9327 4868, Email: bcsydney@sprint.com. Applications close early November.

The STA Travel Grant (I,L,R,C)

- Up to $3,000

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 mid-April.

The Swedish Institute Guest Scholarships (I,L)

- SEK 7,100 per month living allowance
- 9 months (1 academic year)

The scholarships are open to students/researchers who wish to travel to Sweden for studies/research which cannot equally well be pursued in countries other than Sweden. Applicants must establish contact with a Swedish University willing to accept the applicant for the proposed studies. Initial requests for application forms must be made in writing, including the applicant's name and address, nationality, educational background and work experience, knowledge of any languages, statement of the purpose of study/research in Sweden, and a copy of a letter of invitation from a Swedish University Department. Requests for applications should be sent to the Swedish Institute, Department for Exchanges in Education and Research, PO Box 7434, SE-103 91, Stockholm, Sweden. Email: grantinfo@si.se. Homepage: http://www.si.se. Requests for application forms must reach the Swedish Institute before 1 December.

Swiss Government Scholarships (L,R,C)

- Tuition fees, living allowance, medical insurance and assistance with airfares
- 1 academic year

One scholarship is available for art/music and two for other disciplines, to undertake postgraduate study or attend an art school/conservatory in Switzerland. Applicants will be required to pass a language test in German or French. Applicants must be aged under 35. Applications close early October.

The Tokyo Metropolitan Government Foreign Student Scholarship Program (L,R,C)

- 200,000 yen per month, tuition and travel expenses, plus allowances
- Up to 2.5 years

Scholarships are available for a Masters degree or postgraduate research at Tokyo Metropolitan University, or Tokyo Metropolitan Institute of Technology. Applicants

must be aged under 35 years, be Australian Citizens from New South Wales, and be graduates of a university in NSW. Applications close early April.

The Turkish Government Language & Culture and Higher Education Scholarships (I,L)

Scholarships are available to high school graduates to undertake study at a Turkish University. Students may be required to undertake a one year Turkish language course before commencement of the degree. The scholarships pay a monthly allowance for the duration of the course. Scholarships are also available to university graduates who would like to attend Turkish Language and Culture Summer Courses conducted by Turkish Studies Centre. Further information is available from the Embassy of the Republic of Turkey, 60 Mugga Way, Red Hill ACT 2603. Applications close 30 May for Language and Culture Scholarships, and 15 July for Higher Education Scholarships.

University College London Scholarships

The University College London offers various scholarships to students from overseas, who hold an offer of admission to a full-time programme of study at UCL. Applicants must be self-financing and liable to pay tuition fees at the rate for overseas students. Information and applications are available from the International Office, University College London, Gower St, London WC1E 6BT, UK, Tel +44 171 380 7708, Fax +44 171 380 7380, Email: international@ucl.ac.uk.

Yokoyama Scholarship Awards (L,R,C)

Assistance may be available for undergraduate and postgraduate study at a Japanese University.

Information is available from Mr Masao Iwashita, Secretary-General, Yokoyama Scholarship Foundation, 6F Shiozaki Building, 2-7-1 Hirakawacho, Chiyoda-Ku, Tokyo 102 Japan, Tel (813) 3238 2913, Fax (813) 5275 1677.

Faculty Scholarships

Faculty of Engineering

Engineering @ UNSW Exchange Scholarships (L)

Applicants for The UNSW International Exchange Travel Scholarships administered by the International Student Centre will be considered for these awards. There is no separate application form.

Top-Up Engineering @ UNSW Exchange Scholarships

- $500

Students undertaking an undergraduate degree in the Faculty of Engineering who are offered an International Exchange Travel Scholarship will also be offered the Top-Up Scholarship.

Engineering @ UNSW Exchange Scholarships

- $1,500

Students undertaking an undergraduate degree in the Faculty of Engineering who were unsuccessful in their application for an International Exchange Travel Scholarship may be eligible for an Engineering @ UNSW Exchange Scholarship. Selection will be based on the application for the International Exchange Travel Scholarship and academic merit.

Mechanical and Manufacturing Engineering

The NSK Silver Jubilee Scholarship for Study in Japan (L)

- Up to $15,000 for study in Japan
- From 3 to 6 months

The scholarship is open to undergraduate or postgraduate students in the School of Mechanical and Manufacturing Engineering at UNSW, whose thesis projects would be enhanced by work in a Japanese organisation in Japan. The scholarship may cover expenses related to a three-six month stay in Japan (eg travel expenses, living costs, fees etc), for students to work on their thesis project with industry, universities, or government research bodies etc. The scholarship is awarded on the basis of academic merit, a demonstrated interest in Japan and an assessment of their progression on their project. Information is available from Professor B.E. Milton, Head of School, Mechanical and Manufacturing Engineering, Tel (02) 9385 4088, Fax (02) 9663 1222, Email: B.Milton@unsw.edu.au. Applications normally close at the end of each year.

Prizes

The following information summarises prizes awarded by the University. Prizes are grouped by level as follows: Undergraduate, common Undergraduate/Postgraduate, Postgraduate. Within these groups prizes are listed under the faculty, school or department in which they are awarded. Prizes which are not specific to any school are listed under General. 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.

Prize information is normally provided in the following format:

- Prize value
- Conditions

Undergraduate Prizes

The University Of New South Wales (General Category for Prizes)

The Heinz Harant Challenge Prize

- $1000 (bi-annual prize)

For an original piece of assessable work submitted in the course of completing a General Education subject

The Sydney Technical College Union Award

- $400 and a bronze medal

For leadership in student affairs combined with marked academic proficiency by a graduand

The UNSW Human Rights Essay Prize

- $400

For the best research essay on a Human Rights topic by a student enrolled at the University of New South Wales proceeding to a Bachelor degree

Faculty of Engineering

The Institution of Engineers Australia Award

- $500

For the best performance by a final or equivalent year student in the Bachelor of Engineering or Bachelor of Science (Engineering) degree course offered by the Schools of Civil and Environmental Engineering, Electrical Engineering and Telecommunications, Computer Science and Engineering, Mechanical and Manufacturing Engineering, Chemical Engineering and Industrial Chemistry, Mining Engineering and Textile Technology (Engineering option only)

The John Fraser Memorial Award

- $130

For the best performance in Year 1 or part-time equivalent of a Bachelor degree course offered by the Faculty of Engineering

School of Chemical Engineering and Industrial Chemistry

The Abbott Laboratories Pty Limited Prize

- $200

For the best performance in Year 4 of the Bachelor of Engineering in Chemical Engineering degree course

The Australasian Corrosion Association (NSW Branch) Award

- $150 and 1 year membership of the Association

For the best performance in INDC3041 Corrosion in the Chemical Industry

The Australian Institute of Energy (AIE) Prize

- $150

For the best performance in a subject selected by the Head of School

The BHP Engineering Prize

- $150

For the best performance in Year 3 of the Bachelor of Engineering in Chemical Engineering degree course

The BOC Gases Prize

- $200

For meritorious performance in CHEN4081 Design Project

The Bristol-Myers Squibb Prize

- $200

For the best performance in CHEN4030 Environmental Pollution Control

The Cargill Australia Prize

- $500

For the best performance in CHEN4120 Process Plant Management and Operation

The Dorr-Oliver Prize

- $200

For the best performance in CHEN3040 Separation Processes 1

The Dow Corning / Millenium Inorganic Chemicals Prize

- $500

For the best performance in the Environmental Management component of CHEN4100 Professional Electives

The Dow Corning Prize

- $300

For the best performance in CHEN4081 Design Project

The Dow Corning Prize

- $300

For the best performance in CHEN4090 Research Project

The Fuel Technology Staff Prize

- $200

For the best performance in FUEL4090 Fuel and Energy Research Project

The Goodman Fielder Ingredients Prize

- $250

For the best performance in CHEN3090 Chemical Engineering Applications

The Hoechst Australia Prize

- $200

For meritorious performance in CHEN4120 Process Plant Management and Operation

The Johnson Matthey Prize

- $500

For the best performance in the Bachelor of Science in Industrial Chemistry degree course

The National Starch & Chemical Prize

- $500

For the best performance in POLY3010 Polymer Science

The RGC Prize

- $200

For the best performance in CEIC2010 Instrumental Analysis

The RGC Prize

- $200

For the best performance in MINP4010 Hydrometallurgical Processes

The Shell Prize

- $100

For a student who has, in the opinion of the Head of School, performed some meritorious activity of note either inside or outside the University

The Shell Prize

- $200

For the best performance in FUEL4010 Fuel and Energy Engineering 2

The Shell Prize (Year 2)

- $100

For the best performance in Year 2 or equivalent part-time stage of the Bachelor Engineering in Chemical Engineering or Industrial Chemistry courses, including sporting and student activities

The Shell Prize (Year 3)

- $200

For the best performance by a student in Year 3 or equivalent part-time stage of Bachelor Engineering in Chemical Engineering or Industrial Chemistry courses, including sporting and student activities

The Shell Prize (Year 4)

- $200

For the best performance by a student in Year 4 or equivalent part-time stage of Bachelor Engineering in Chemical Engineering or Industrial Chemistry, including sporting and student activities

The Simon Carves Australia Prize

- $200

For the best performance in CHEN3060 Process Plant Engineering

The Simon Carves Australia Prize

- $200

For meritorious performance in CHEN4081 Design Project

The Waste Service NSW Prize

- $200

For meritorious performance in the Environmental Management component of CHEN4100 Professional Electives

The Wattyl Australia / James Hardie Prize

- $400

For meritorious performance in the Environmental Management component of CHEN4100 Professional Electives

The Western Mining Corporation Ltd Prize

- $150

For the best performance in CHEN2050 Chemical Engineering Laboratory 1

The Western Mining Corporation Ltd Prize

- $150

For the best performance in CHEN3080 Chemical Engineering Laboratory 2

School of Civil and Environmental Engineering

The Association of Consulting Structural Engineers of New South Wales Prize

- $250

For the best performance in CIVL3303 Structural Design in the Bachelor of Engineering in Civil Engineering degree course

The Association of Consulting Structural Engineers of New South Wales Prize

- $300

For the best performance in CIVL4203 Structural Engineering in the Bachelor of Engineering in Civil Engineering degree course

The Australian Institute of Traffic Planning and Management Prize

- $200, 1 year free subscription to AITPM and a plaque

For the best performance in CIVL4844 Transport Major in the Bachelor of Engineering in Civil Engineering degree course

The Baulderstone Hornibrook Prize

- $500

For the best performance in Engineering Construction and Management in the Bachelor of Engineering in Civil Engineering degree course

The Computing and Graphics Prize

- $400

For the best performance in CIVL1015 Computing in the Bachelor of Engineering in Civil Engineering or Environmental Engineering degree course

The Crawford Munro Memorial Prize

- $300

For the best performance in CIVL3705 Water Resources in the Bachelor of Engineering in Civil Engineering degree course

The Iplex Pipelines Award

- $500 and a plaque

For the best performance in CIVL4605 Water Supply and Wastewater Disposal in the Bachelor of Engineering in Civil Engineering degree course

The Jeffery and Katauskas Prize

- $500

For the best performance in CIVL3402 Geotechnical Engineering 1 in the Bachelor of Engineering in Civil Engineering or Bachelor of Environmental Engineering degree course

The Sydney Water Gold Medal

- $200 and a gold medal

For the highest aggregate in CIVL4017 Water Engineering (Major) in the Bachelor of Engineering in Environmental Engineering degree course.

The TDA Timber Engineering Prize

- $150

For the best performance in Timber Engineering or a Timber Related Project in the Bachelor of Engineering in Civil Engineering or Bachelor of Engineering in Environmental Engineering degree course

The Welding Technology Institute of Australia Prize

- Books worth approximately $200 and 1 year membership to the Institute

For the best performance in CIVL4403 Materials Engineering 2

School of Electrical Engineering and Telecommunications

The Electricity Supply Engineers' Association Prize

- $200

For 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 in Electrical Engineering degree course

The Institution of Electrical Engineers UK Prize

- $250, an IEE certificate and 2 years Associate Membership of the IEE

For the best performance in the final year thesis/project in the Bachelor of Engineering in Electrical Engineering degree course

The J Douglas Maclurcan Prize

- Book voucher worth $60

For an outstanding performance in the field of Control Systems in the final year of the Bachelor of Engineering in Electrical Engineering degree course

The Photovoltaics Prize (Applied Photovoltaics)

- $500

For the best performance in ELEC4540 Applied Photovoltaics in the Bachelor of Engineering degree course

The Photovoltaics Thesis Prize

- $500

For the best performance in an undergraduate thesis in the area of Photovoltaics in the Bachelor of Engineering degree course

Department of Electric Power Engineering

The energyAustralia Electrical Energy 3rd Year Prize

- $500

For the best combined performance in subjects in Electric Power Engineering in Year 3 of the Bachelor of Engineering in Electrical Engineering degree course

The energyAustralia Electrical Energy 4th Year Prize

- $500 and a silver medal

For the best combined performance in final year subjects and thesis offered by the Department of Electric Power Engineering

School of Geomatic Engineering

The Angus-Leppan Prize

- $300

For the best performance in Spatial Information System subjects in the Bachelor of Surveying or Bachelor of Engineering in Geomatic Engineering degree course

The Australian Photogrammetric and Remote Sensing Society (NSW) Prize

- $150

For the best performance in Photogrammetric subjects in the Bachelor of Surveying or Bachelor of Engineering in Geomatic Engineering degree course

The BHP Engineering Prize in Surveying

- $2000

For the best overall performance by a Year 3 student proceeding to Year 4 in the Bachelor of Surveying or Bachelor of Engineering in Geomatic Engineering degree course

The Board of Surveyors Medal

- A medal

For an outstanding performance in the final year of the Bachelor of Surveying or Bachelor of Engineering in Geomatic Engineering degree course

The Bowdens Prize for Management

- $2500

For superior performance in management subjects and contributions to student or community activities by a student in the Bachelor of Surveying or Bachelor of Engineering in Geomatic Engineering degree course

The CIVILCAD Prize

- Civilcad software package

For the best performance in GMAT3122 Computer Graphics 1, GMAT6052 Field Projects 2 and GMAT8612 Land Management and Development Project 2 in the Bachelor of Engineering in Geomatic Engineering degree course

The Consulting Surveyors' NSW Prize in Land Development

- $500

For the best performance in GMAT7612 Land Management and Development Project 1 and GMAT8612 Land Management and Development Project 2 in the Bachelor of Engineering in Geomatic Engineering degree course

The Institution of Surveyors New South Wales Incorporated Prize

- Books valued at approximately $200 and an inscribed plaque

For the best performance by a graduating student in the Bachelor of Surveying or the Bachelor of Engineering in Geomatic Engineering degree course

The LandInfo First Year Prize

- $1000

For the best performance in all Year 1 subjects in the Bachelor of Engineering in Geomatic Engineering degree course.

The LandInfo Second Year Prize

- $1000

For the best performance in all Year 1 subjects in the Bachelor of Engineering in Geomatic Engineering degree course.

The R S Mather Memorial Prize

- $250

For an outstanding performance in Geodesy subjects in the Bachelor of Surveying or Bachelor of Engineering in Geomatic Engineering degree course

The School of Geomatic Engineering Prize

- $2000

For the best overall performance by a Year 1 student proceeding to Year 2 in the Bachelor of Surveying or the Bachelor of Engineering in Geomatic Engineering degree course

The School of Geomatic Engineering Prize

- $1000

For the best overall performance by a Year 2 student proceeding to Year 3 in the Bachelor of Surveying or the Bachelor of Engineering in Geomatic Engineering degree course

School of Materials Science and Engineering

The ACI Glass Packaging Prize

- $200

For outstanding quality in an Honours Thesis in one of the areas of glass or glass-ceramics in the Bachelor of Engineering in Ceramic Engineering degree course

The ANSTO Prize

- $100

For the best performance in Year 4 of the Bachelor of Engineering in Ceramic Engineering degree course

The Austral Bricks Prize

- $100

For the best performance in Year 3 of the Bachelor of Engineering in Ceramic Engineering degree course

The Australasian Ceramic Society Prize

- $100

For the highest overall course aggregate by a student completing the final year of the Bachelor of Engineering in Ceramic Engineering degree course

The Australasian Corrosion Association (NSW) Prize

- $150

For the best performance in MATS1213 Design for Corrosion Control in the Bachelor of Metallurgical Engineering degree course

The Boral Bricks Prize

- $500

For the best performance in MATS2273 Chemistry of Ceramic Processing, Unit 2, Technical and Non-Technical Ceramics in the Bachelor of Engineering in Ceramic Engineering degree course

The Capral Aluminium Limited Prize

- $200

For the best performance in MATS1284 Light Alloys

The Carpenter Advanced Ceramics Prize

- $100

For the best overall academic performance in Year 2 of the Bachelor of Engineering in Ceramic Engineering degree course

The Commercial Minerals Limited Prize

- $200

For the best performance in MATS2133 Ceramic Raw Materials in the Bachelor of Engineering in Ceramic Engineering degree course

The Fernz Minerals Prize

- $250

For the most aptitude and technique shown in the combined laboratory subjects MATS2153 Ceramic Processing Laboratory and MATS2203 Physico-Chemical Ceramics Laboratory (with each subject receiving one half of the weighting for the average) in the Bachelor of Engineering in Ceramic Engineering degree course

The Ferro Corporation (Australia) Prize

- $250

For the best performance in MATS2123 Ceramic Process Principles 2 in the Bachelor of Engineering in Ceramic Engineering degree course

The Hugh Muir Prize

- $275

For the best performance by a student in the final year seminar class, or who in the opinion of the Head of School, has contributed most to the corporate life of the School of Materials Science and Engineering

The Institute of Materials Engineering Australasia Prize

- $200 and 1 year membership of the Institute

For the best performance in MATS1022 Materials Process Principles

The Max Hatherly Prize

- $275

For the best performance in MATS1002 Microstructural Analysis

The Monier PGH Prize

- $1000

For the best performance by a graduating student in the Bachelor of Engineering in Ceramic Engineering degree course

The Sialon Ceramics Prize

- $100

For the best performance in an honours thesis that reflects an advancement in the technology and development of advanced ceramics in the Bachelor of Engineering in Ceramic Engineering degree course

The Taylor Ceramic Engineering Prize

- $150 and a Plaque

For the greatest overall amount of ingenuity shown in professional activities by a graduating student in the Bachelor of Engineering in Ceramic Engineering degree course

The Thermal Ceramics Australia Pty Limited Prize

- $200

For the best performance in MATS2254 Ceramic Engineering Design in the Bachelor of Engineering in Ceramic Engineering degree course

The Wallarah Minerals Prize

- $100

For the best performance in an honours thesis in the Bachelor of Engineering in Ceramic Engineering degree course

The Welding Technology Institute of Australia Prize

- Books worth approximately $200 and 1 year membership of the Institute

For the best performance in MATS1214 Welding and Other Joining Processes

The Western Mining Corporation Limited Prize

- $150

For the best overall performance in Year 3 full-time (or its part-time equivalent) in the Bachelor of Metallurgical Engineering or Bachelor of Science (Technology) in Metallurgy degree course

The Western Mining Corporation Limited Prize

- $150

For the best overall performance in Year 4 full-time (or its part-time equivalent) in the Bachelor of Metallurgical Engineering in Process Metallurgy or the Bachelor of Science (Technology) in Metallurgy degree course

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School of Mining Engineering

The Stan Sawyer Memorial Prize

- $400

For the best performance in an Honours thesis on a topic relating to coal mining in the Bachelor of Engineering in Mining Engineering degree course

The Western Mining Corporation Limited Melbourne Prize

- $200

For the best overall performance in the Bachelor of Engineering in Mining Engineering degree course

The Western Mining Corporation Limited Perth Prize

- $150

For the best overall performance in Year 3 of the Bachelor of Engineering in Mining Engineering degree course

The Western Mining Corporation Limited Perth Prize

- $150

For the best overall performance in the final year of the Bachelor of Engineering in Mining Engineering degree course

School of Petroleum Engineering

The AusIMM/Santos Prize

- $500

For the best performance in Year 3 of the Bachelor of Engineering in Petroleum Engineering degree course

The ESSO Australia Prize for an Outstanding Contribution in a Non-Technical Subject

- $500

For the best performance in PTRL4010 Communication Skills and Business Practices for Engineers in Year 4 of the Bachelor of Engineering in Petroleum Engineering degree course

The ESSO Australia Prize for Excellence in a Core Technical Subject

- $500

For the best performance in PTRL3001 Reservoir Rock Properties and Fluid Flow in Porous Media in Year 3 of the Bachelor of Engineering in Petroleum Engineering degree course

The Fletcher Challenge Prize for a High Achieving Student in the Area of Drilling Engineering

- $500

For the best performance in PTRL3009 Fundamentals in Drilling Engineering in Year 3 of the Bachelor of Engineering degree course

The Shell Development (Australia) Pty Ltd Prize

- $500

For the best performance in CHEN4030 Safety and Environment

The Woodside Energy Prize for Outstanding Performance in Natural Gas Engineering

- $500

For an outstanding performance in PTRL4005 Natural Gas Engineering in Year 4 of the Bachelor of Engineering degree course

Undergraduate and Postgraduate Prizes

School of Electrical Engineering and Telecommunications

The Photovoltaics Prize (Advanced Photovoltaics)

- $500

For the best performance in ELEC9505 Solar Cells in the Bachelor of Engineering, Master of Engineering Science or Doctor of Philosophy degree course

Postgraduate Prizes

School of Civil Engineering and Environmental Science

The Maunsell Project Report Prize

- $500

For the best performance in CIVL8909 or CIVL9909 Project Report (9 credits) or GEOL9504 or GEOL9604 Project Report (9 credits) in the Master of Engineering Science or Master of Applied Science degree course

The Maunsell Waste Management Prize

- $500

For the best aggregate score in CIVL8872/9872 Solid Waste Management and CIVL8881/CIVL9881 Hazardous Waste Management in the Master of Engineering Science or Master of Applied Science degree course

School of Mechanical and Manufacturing Engineering

The MESA Maintenance Prize

- $350

For the best performance in MECH4150/MECH9150 Design and Maintenance Components

Notes

Notes

Theatres

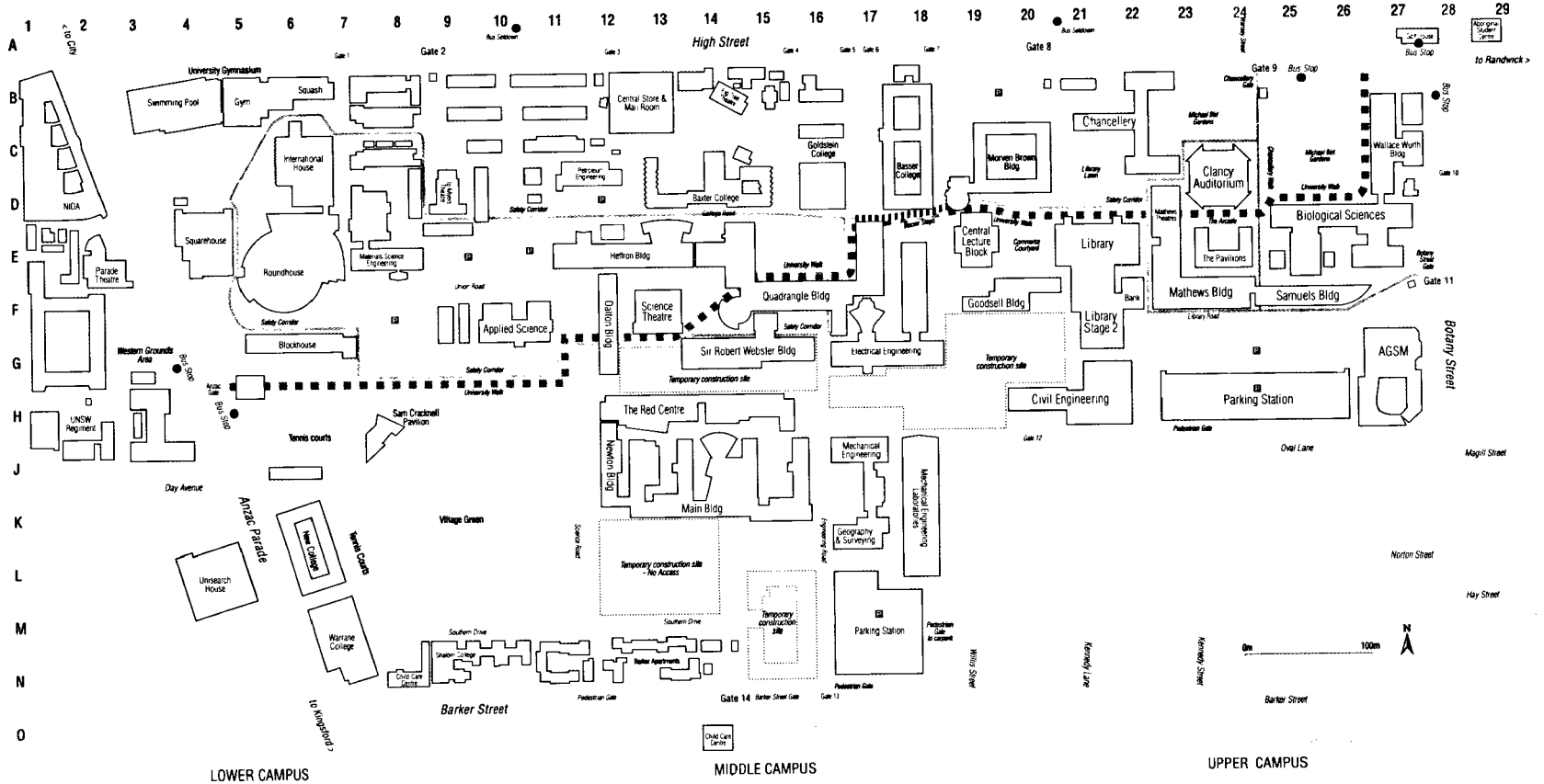
Applied Science Theatre **F11**
Athol Lykke Theatre **C27**
Biomedical Theatres **E27**
Central Lecture Block **E19**
Chemistry Theatres (*Dwyer, Mellor, Murphy, Nyholm, Smith*) **E12**
Clancy Auditorium **C24**
Classroom Block (*Western Grounds*) **H3**
Fig Tree Theatre **B14**
Hefffron Theatres **E13**
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**
Webster Theatres **G15**

Buildings

AGSM **G27**
Applied Science **F10**
Arcade **D24**
Architecture **H14**
Barker Apartments **N13**
Barker Street Gatehouse, Gate 14 **N14**
Basser College (*Kensington*) **C18**
Baxter College **D14**
Biosciences **D26**
Central Store **B13**
Chancellery **C22**
Dalton (*Chemistry*) **F12**
Goldstein College (*Kensington*) **D16**
Golf House **A27**
Gymnasium **B5**
High Street Gatehouse, Gate 9 **B24**
Heffron, Robert (*Chemistry*) **E12**
International House **C6**
John Goodsell (*Commerce and Economics*) **F20**
Kensington Colleges (*Office*) **C17**
Library (*University*) **E21**
Link **B6**
Main **K15**
Maintenance Workshop and Central Store **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**
Red Centre **H13**
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 and Research Centre **E20**
Aboriginal Student Centre **A29**
Accommodation (*Housing Office*) **E17**
Accounting **E15**
Admissions **C22**
Alumni **C22**
Anatomy **C27**
Applied Bioscience **D26**
Applied Economic Research Centre **F20**
Applied Geology **F10**
Archives, University **E21**
Arts and Social Sciences (*Faculty Office*) **C20**
Asia-Australia Institute: 45 Beach Street, Coogee
Asian Business and Language Studies **E15**
Audio Visual Unit **F20**
Australian Graduate School of Management **G27**
Banking and Finance **E15**
Biochemistry and Molecular Genetics **D26**
Biological Science **D26**
Biomedical Library **F23**
Biotechnology **F25**
Built Environment (*Faculty Office*) **H14**
Business Law and Taxation **F20**
Campus Services **C22**
Careers Service **E15**
Cashier's Office **C22**
Chaplains **E4**
Chemical Engineering and Industrial Chemistry **F10**
Chemistry **E12**
Civil and Environmental Engineering **H20**
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
Counselling Service **E15**
Economics **F20**
Education Studies **G2**
Educational Testing Centre **E4**
Electrical Engineering **G17**
Energy Research, Development & Information Centre **F10**
Engineering (*Faculty Office*) **K17**
English **C20**
Equity and Diversity Unit **E15**
Examinations **C22**
Facilities Department **C22, B14A**
Fees Office **C22**
Food Science and Technology **B8**
Geography **K17**
Geomatic Engineering **K17**
Graduate School of Biomedical Engineering **F25**
Graduate School of Engineering (MBT Program) **K17**
Groundwater Centre **F10**
Health Service, University **E15**
Health Services Management **F25**
History **C20**
Housing **E15**
Human Resources **C22**
Industrial Relations and Organisational Behaviour **F20**
Information, Library & Archives Studies **F23**
Information Systems **E15**
Information Technology Unit **F21**
Institute of Languages, 22-32 King St, Randwick
International Student & Scholar Services **H14**
IPACE Institute **F23**
Kanga's House **O14**
Law (*Faculty Office*) **F21**
Law Library **F21**
Legal Studies and Taxation **F20**
Library Lawn **D21**
Life Sciences (*Faculty Office*) **D26**
Loans **C22**
Lost Property **H11**
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**
Mining Engineering **K15**
Modern Language Studies **C20**
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**
Planning and Urban Development **K15**
Political Science **C20**
Pooh Corner **N8**
Printing Section **C22**
Professional Development Centre **E17**
Psychology **F23**
Publishing and Printing Services **C22**
Remote Sensing and Geographic Information Systems **K17**
Research Office: 34 Botany Street, Randwick
Safety Science **B11**
Science and Technology (*Faculty Office*) **E12**
Science and Technology Studies **C20**
Security **H13**
Social Science and Policy **C20**
Social Policy Research Centre **F25**
Social Work **G2**
Sociology **C20**
Sport and Recreation Centre **B6**
Squash Courts **B7**
Student Centre (*off Library Lawn*) **C22**
Student Recruitment Office **C22**
Students' Guild **E15**
Swimming Pool **B4**
Tennis Pavilion **J6**
Textile Technology **G14**
Theatre, Film and Dance Studies **B10**
UNSW Bookshop **E15**
UNSW International **H14**
WHO Regional Training Centre **C27**
Wool and Animal Sciences **G14**
Works and Maintenance **B14A**



The University of New South Wales • Kensington Campus

UNSW

This Handbooks has been specifically designed as a source of detailed reference information for first year, re-enrolling undergraduate and postgraduate students.

Separate Handbooks are published for:

Arts and Social Sciences
Built Environment
College of Fine Arts
Commerce and Economics
Engineering
Law
Medicine
Science
Australian Graduate School of Management (AGSM)
Australian Taxation Studies Program (ATAX)
University College, Australian Defence Force Academy(ADFA)
General Education.

For further information about the University – its organisation; staff members; description of disciplines; scholarships; prizes and so on, consult the University Calendar (Summary Volume). For further information on student matters, consult the UNSW Student Guide.