THE UNIVERSITY OF
NEW SOUTH WALES

Faculty of
Applied Science

HANDBOOK

1996

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Subjects, courses and any arrangements for courses including staff allocated as stated in this Handbook are an expression of intent only. The University reserves the right to discontinue or vary arrangements at any time without notice. Information has been brought up to date as at 1 November 1995, but may be amended without notice by the University Council.

CREDIT POINTS - IMPORTANT NOTE

From 1996, UNSW is introducing a university wide credit point system for all subjects offered to both undergraduate and postgraduate students. The system will mean that a subject will have the same credit irrespective of which faculty's course it is counting towards. Students will be 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 for the standard course in 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Old subject measures have been replaced by the new university credit point. Every effort has been made to ensure the accuracy of the credit point values shown for all subjects. However, if any inconsistencies between old and new credit point measures cause concern, students are advised to check with their faculty office for clarification before making 1996 subject selections based on the credit points shown in this handbook.

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Contents

Introduction

Engineering and science disciplines that are directly concerned with aspects of Australia's resources have been established in the Faculty of Applied Science. Interdisciplinary and multidisciplinary course options are available to students through the various Schools within the Faculty - Applied Bioscience, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, Mines, as well as the Department of Safety Science, and the Centre for Petroleum Engineering. The Faculty of Applied Science also has a number of specialised research and teaching centres including Commonwealth Cooperative Research Centres, Key Centres and a UNESCO Centre.

Undergraduate courses available are:

- Applied Geology (including specialisation in Mineral Exploration and Mining Geology, Sedimentary Basin Studies, Geophysics, Engineering Geology, Environmental Geology, Geochemistry and Hydrogeology
- Biotechnology
- Bioprocess Engineering
- Chemical Engineering (including Fuel and Energy Engineering and Mineral Engineering)
- Food Science and Technology
- Geography (including Applied Physical Geography, Applied Economic Geography, and Human and Physical Resources)
- Industrial Chemistry (including Polymer Science)
- Materials Science and Engineering (including Ceramic Engineering, Materials Engineering, and Metallurgical Engineering)
- Mining Engineering
- Petroleum Engineering
- Textile Management
- Textile Technology (including Textile Chemistry, Textile Engineering and Textile Physics)
- Wool and Pastoral Sciences

In most schools a variety of options are available, including joint degrees in other faculties. Students should discuss their programs with appropriate staff to ensure that their chosen course of study is appropriate to their aims and aspirations.

The importance of applied science to the University of New South Wales, and to the wider community, is fully recognised and is especially referred to in the University Act of Incorporation. The Faculty of Applied Science is dynamic, with changing activities and programs to meet the rapid technological developments in the applied sciences. Many of the staff of the Faculty have achieved international recognition for their work, and there is a continuing and wide range of research programs underway. The staff are enthusiastic, and I hope that you will share their enthusiasm.

Once the academic year begins, it is essential that you participate fully in your study program from the first day of the first year. You are also urged to play an active role in the extramural activities of the University, especially in the student societies in the Schools.

Explanatory pamphlets and brochures are issued at enrolment and these, together with the Calendar, should be consulted for further information. You should not hesitate to contact the appropriate School offices if you have questions or problems.

GJS Govett
Dean
Faculty of Applied Science

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

	1996	1997
Session 1 (14 weeks)	4 March to 4 April 15 April to 14 June	3 March to 27 March 7 April to 13 June
Mid-session recess	5 April to 14 April	28 March to 6 April
Study period	15 June to 20 June	14 June to 19 June
Examinations	21 June to 9 July	20 June to 8 July
Mid-year recess	10 July to 28 July	9 July to 27 July
Session 2 (14 weeks)	29 July to 27 September 8 October to 8 November	28 July to 26 September 7 October to 7 November
Mid-session recess	28 September to 7 October	27 September to 6 October
Study period	9 November to 14 November	8 November to 13 November
Examinations	15 November to 3 December	14 November to 2 December

Important dates for 1996

January

M 1 New Year's Day - Public Holiday
M 15 Medicine IV - Term 1 begins
Th 18 Medicine V - Term 1 begins
F 26 Australia Day - Public Holiday
T 30 Enrolment period begins for new undergraduate students and undergraduate students repeating first year

February

M 12 AGSM Open Learning GMQ and GDM programs - Semester 1 begins
M 26 Medicine VI - Term 2 begins
AGSM MBA program - Year 1 classes - Term 1 begins

March

F 1 Last day for acceptance of provisional enrolment by re-enroling students
M 4 Session 1 begins for faculties other than Medicine and AGSM
AGSM MBA program - Year 2 classes - Term 1 begins
University College, ADFA - Session 1 begins
F 15 Last day applications are accepted from students to enrol in Session 1 or whole year subjects
Su 17 Medicine IV - Term 1 ends
M 18 Medicine IV - Term 2 begins
Su 24 Medicine V - Term 1 ends
Su 31 Last day for students to discontinue without failure subjects which extend over Session 1 only
HECS Census Date for Session 1

April

M 1 Medicine V - Term 2 begins
F 5 Good Friday - Public Holiday
Mid-session recess begins for faculties other than Medicine, AGSM and University College, ADFA
S 6 Easter Saturday - Public Holiday
M 8 Easter Monday - Public Holiday
Su 14 Mid-session recess ends for faculties other than Medicine, AGSM and University College, ADFA
Medicine VI - Term 2 ends
M 15 Medicine VI - Recess begins
Su 21 Medicine VI - Recess ends
M 22 Medicine VI - Term 3 begins
Th 25 Anzac Day - Public Holiday
Su 28 Medicine IV - Term 2 ends
M 29 Medicine IV - Recess begins

May

S 4 University College, ADFA - May recess begins
Su 5 Medicine IV - Recess ends
M 6 Medicine IV - Term 3 begins
F 10 AGSM MBA program - all classes - Term 1 ends
M 13 AGSM MBA program - all classes - Examinations begin
14 Publication of provisional timetable for June examinations
F 17 AGSM MBA program - all classes - Examinations end
Su 19 University College, ADFA - May recess ends
W 22 Last day for students to advise of examination clashes
S 25 AGSM Open Learning GDM program - Semester 1 ends
AGSM Open Learning GDM program - Examination

June

S 1 AGSM Open Learning GMQ program - Semester 1 ends
AGSM Open Learning GMQ program - Examination
Su 2 Medicine V - Term 2 ends
Medicine VI - Term 3 ends
M 3 AGSM MBA program - all classes - Term 2 begins
Medicine VI - Term 4 begins
T 4 Publication of timetable for June examinations
M 10 Queen's Birthday - Public Holiday
T 11 Medicine V - Term 3 begins
F 14 Session 1 ends for faculties other than Medicine, AGSM and University College, ADFA
S 15 Study recess begins for faculties other than Medicine, AGSM and University College, ADFA
Su 16 Medicine IV - Term 3 ends
M 17 Medicine IV - Term 4 begins
Th 20 Study recess ends for faculties other than Medicine, AGSM and University College, ADFA
F 21 Examinations begin for faculties other than Medicine, AGSM and University College, ADFA
University College, ADFA - Session 1 ends
S 22 University College, ADFA - Mid-year recess begins
M 24 University College, ADFA - Examinations begin

July

F 5 University College, ADFA - Examinations end
T 9 Examinations end for faculties other than Medicine, AGSM and University College, ADFA
W 10 Mid-year recess begins for faculties other than Medicine, AGSM and University College, ADFA
M 15 AGSM Open Learning GMQ and GDM programs - Semester 2 begins
Su 21 University College, ADFA - Mid-year recess ends
M 22 University College, ADFA - Session 2 begins
F 26 Medicine VI - Term 4 ends
S 27 Medicine VI - Recess begins
Su 28 Mid-year recess ends for faculties other than Medicine, AGSM and University College, ADFA
M 29 Session 2 begins for faculties other than Medicine, AGSM and University College, ADFA

August

Su 4 Medicine VI - Recess ends
M 5 Medicine VI - Term 5 begins
F 9 Last day applications are accepted from students to enrol in Session 2 subjects
Last day for students to discontinue without failure subjects which extend over the whole academic year
AGSM MBA program - all classes - Term 2 ends
Su 11 Medicine IV - Term 4 ends
Medicine V - Term 3 ends
M 12 AGSM MBA program - all classes - Examinations begin
Medicine IV - Recess begins
F 16 AGSM MBA program - all classes - Examinations end
Su 18 Medicine IV - Recess ends
M 19 Medicine IV - Term 5 begins
Medicine V - Term 4 begins
S 31 Last day for students to discontinue without failure subjects which extend over Session 2 only
HECS Census Date for Session 2

September

M 2 AGSM MBA program - all classes - Term 3 begins
S 7 Open Day
Su 15 Medicine VI - Term 5 ends
M 16 Medicine VI - Term 6 begins
F 27 Closing date for applications to the Universities Admission Centre
S 28 Mid-session recess begins for faculties other than Medicine and AGSM
University College, ADFA - September recess begins
Su 29 Medicine IV - Term 5 ends
M 30 Medicine IV - Term 6 begins

October

M 7 Labour Day - Public Holiday
Mid-session recess ends for faculties other than Medicine and AGSM
University College, ADFA - September recess ends
T 8 Publication of provisional timetable for November examinations
W 16 Last day for students to advise of examination clashes
Su 20 Medicine V - Term 4 ends
F 25 University College, ADFA - Session 2 ends
S 26 AGSM Open Learning GDM program - Examination
Su 27 Medicine VI - Term 6 ends
M 28 University College, ADFA - Examinations begin
T 29 Publication of timetable for November examinations

November

S 2 AGSM Open Learning GDM program - Semester 2 ends
AGSM Open Learning GDM program - Examination
F 8 Session 2 ends for faculties other than Medicine, AGSM and University College, ADFA
AGSM MBA program - all classes - Term 3 ends
S 9 Study recess begins for faculties other than Medicine, AGSM and University College, ADFA
AGSM Open Learning GMQ program - Semester 2 ends
AGSM Open Learning GMQ program - Final Examination
Su 10 Medicine IV - Term 6 ends
M 11 AGSM MBA program - all classes - Examinations begin
Th 14 Study recess ends for faculties other than Medicine, AGSM and University College, ADFA
F 15 Examinations begin for faculties other than Medicine, AGSM and University College, ADFA
University College, ADFA - Examinations end
AGSM MBA program - all classes - Examinations end

December

T 3 Examinations end for faculties other than Medicine, AGSM and University College, ADFA
W 25 Christmas Day - Public Holiday
Th 26 Boxing Day - Public Holiday

Comprises Schools of Applied Bioscience, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, Mines, Department of Safety Science, and the Centre for Petroleum Engineering Studies; as well as Centres located within Schools- Applied Polymer Science, Bioengineering, Food Industry Development, Minerals Engineering, Particle and Catalyst Technologies, Key Centre for Mines and the UNESCO Centre for Membrane and Separation Technology. The Faculty is also associated with the Energy Research, Development and Information Centre (ERDIC), the UNSW Groundwater Centre and the Centre for Remote Sensing and Geographic Information Systems. It houses the Cooperative Research Centres for Biopharmaceutical Research and Food Industry Innovation.

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Ashok Kumar Khurana, BSc *Jabalpur*, BE *B'lore*, GradDip *Birm.*, PhD DIC *Lond.*

Senior Lecturer
Henry Alfred Salisch, BSc *Quito Poly. Inst.*, MSc *Oklahoma*, MS *Venezuela Central*
Sheikh Rahman, BSc *Chitt.*, MSc *Strath.*, PhD *Clausthal*

Visiting Lecturers
Guy Allinson, BSc *Leeds.*, DipSocSci *Birm.*
Richard Christian Curnow, BE *Syd.*, BCom *UNSW*
Barry Walsh, BE PhD *Syd.*

Professional Officer
Juan Carlos Zajaczkowski, BE *Buenos Aires*

Administrative Assistant
Jennifer Ruth Lippiatt

Department of Safety Science

Professor of Safety Engineering and Head of Department
Jean Cross, BSc *Manc.*, PhD *Lond.*, FIEAust, MIEE, MAIP, CEng

Visiting Professor of Mechanical Engineering
*Noel Levin Svensson, AM, MMechE PhD *Melb.*, CEng, CPEng, FIEAust, MIMechE

Associate Professor
Chris Winder, BA *Open U.*, MSc *City Lond.*, PhD *Lond.*

Lecturers
Dianne Heather Gardner, BA *Adel.*, MPsychol *UNSW*
Roger Roy Hall, BSc *A.N.U.*, MSc *UNSW*, FESA
Kamal Kothiyal, MSc MTech PhD *I.I.T. Delhi*

Professional Officers
Shaharin Yussof, BEng *Car.*

Administrative Assistant
Barbara Littlewood

Visiting Fellows
Neil Leon Adams, BSc PhD *UNSW*, MESA, MHFS, MAITD, MICOH
Edward Maxwell Nicholls, MD BS *Adel.*, FACOM
Keith Post, BE PhD *UNSW*
Ronald Rosen, MSc *N.Z.*, PhD *UNSW*, CPhys, FInstP, FAIP, FIPSM, FARPS, MACPSEM

**Conjoint appointment with the Faculty of Medicine.*

Energy Research Development and Information Centre (ERDIC)

Director
Associate Professor GD Sergeant

Centre for Remote Sensing and Geographic Information Systems

(in association with the Faculty of Engineering)

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

UNSW Groundwater Centre

(in association with the Faculty of Engineering)

Director
Dr J Jankowski

Senior Lecturer
Richard Ian Acworth, BSc *Leeds*, MSc PhD *Birm.*, FGS

Handbook Guide

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

Read the opening sections of the handbook first, and then read the information contained under **Course Outlines** (Undergraduate or Graduate as appropriate) within the School/Unit you are interested in. 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.

Any subject which is not an Applied Science 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 Applied Science, **Faculty Information**, and **Undergraduate Study, Course Outlines.** Both of these contain specific information relating to undergraduate degrees, including Enrolment Procedures, Conditions for the Award of Degrees, Honours, Course Transfers and a number of other details that you should be familiar with.

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

Graduate Study

No matter which graduate degree course you plan to undertake you must read the general summary of graduate courses in the section, **Course Outlines, Graduate Study.** This covers both research degrees and course work programs. Information relating to the various Masters degrees by course work and Graduate Diplomas is detailed in the appropriate School or Centre 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 Applied Science are only too happy to help you with any queries you might have or problems that need to be sorted out. As a first step, contact the School Office. 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

Prefixes

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

Prefix	Organisational Unit	Faculty/Board
ABIO	School of Applied Bioscience	Applied Science
ACCT	School of Accounting	Commerce and Economics
ANAT	School of Anatomy	Medicine
APSE	Faculty of Applied Science	
BIOC	School of Biochemistry	Biological and Behavioural Sciences
BIOM	Centre for Biomedical Engineering	Engineering
BIOS	School of Biological Science	Biological and Behavioural Sciences
BIOT	Department of Biotechnology	Applied Science
CEIC	School of Chemical Engineering and Industrial Chemistry	Applied Science
CHEM	School of Chemistry	Science
CHEN	Department of Chemical Engineering	Applied Science
CIVL	School of Civil Engineering	Engineering
CMED	School of Community Medicine	Medicine
COMP	School of Computer Science and Engineering	Engineering
ECOH	Department of Economic History	Commerce and Economics
ECON	School of Economics, Departments of Econometrics and Economics	Commerce and Economics
ELEC	School of Electrical Engineering	Engineering
ENVS	Environmental Studies	Biological and Behavioural Sciences
FIBR	School of Fibre Science and Technology	Applied Science
FINS	School of Banking and Finance	Commerce and Economics
FOOD	Department of Food Science and Technology	Applied Science
FUEL	Department of Fuel Technology	Applied Science
GEOG	School of Geography	Applied Science
GEOL	Department of Applied Geology	Applied Science
GMAT	School of Geomatic Engineering	Engineering
GSBE	Graduate School of the Built Environment	Built Environment
HEAL	School of Health Services Management	Professional Studies
INDC	Department of Industrial Chemistry	Applied Science
INFS	School of Information Systems	Commerce and Economics
IROB	School of Industrial Relations and Organisational Behaviour	Commerce and Economics

Prefix	Organisational Unit	Faculty/Board
KCME	Key Centre for Mines	Applied Science
LAND	School of Landscape Architecture	Built Environment
LEGT	Department of Legal Studies and Taxation	Commerce and Economics
LIBS	School of Information, Library and Archive Studies	Professional Studies
MANF	School of Mechanical and Manufacturing Engineering	Engineering
MARK	School of Marketing	Commerce and Economics
MATH	School of Mathematics	Science
MATS	School of Materials Science and Engineering	Applied Science
MECH	School of Mechanical and Manufacturing Engineering	Engineering
MEED	School of Medical Education	Medicine
MICR	School of Microbiology and Immunology	Biological and Behavioural Sciences
MINE	Department of Mining Engineering	Applied Science
MINP	Centre for Minerals Engineering	Applied Science
MNGT	Australian Graduate School of Management	
MSCI	Board of Studies in Science and Mathematics	
PHYS	School of Physics	Science
PLAN	School of Town Planning	Built Environment
POLY	Department of Polymer Science	Applied Science
PROF	Faculty of Professional Studies	
PSYC	School of Psychology	Biological and Behavioural Sciences
PTRL	Department of Petroleum Engineering Studies	Applied Science
SAFE	Department of Safety Science	Applied Science
SOCI	School of Sociology	Arts and Social Sciences
SCTS/ HPST	School of Science and Technology Studies	Arts and Social Sciences
TEXT	Department of Textile Technology	Applied Science
WOOL	Department of Wool and Animal Science	Applied Science

Some People Who Can Help You

If you require advice and information of a general nature contact: Mr G Baldwin, Senior Administrative Officer, Room 1013, Applied Science Building. Tel. 385 4469

For information and advice of a specific nature, contact the appropriate school representative below:

Biotechnology
Ms R Lee, Administrative Officer, Room 110A, Biological Sciences Building. Tel 385 2050

Chemical Engineering and Industrial Chemistry
Ms K Mason, Administrative Officer, Room 316, Applied Science Building. Tel 385 4318.

Food Science and Technology
Mr R Greenwood, Administrative Officer, Room 115, Building B8A Tel 385 4364.

Geography
Ms C Bilic, Administrative Officer, Room 139, Geography and Surveying. Tel 385 4390.

Materials Science and Engineering
Mr O Andersen, Administrative Assistant, Room 110B, Materials Science and Engineering Building. Tel. 385 4436.

Mines (Applied Geology and Mining Engineering)
Ms R Benninghaus, Administrative Officer, Room 810, Applied Science Building. Tel. 385 4262 or Ms L Henry, Administrative Assistant, Room 159C, Main Building. Tel 385 4516.

Petroleum Engineering
Ms J Lippatt, Room 115, Petroleum Engineering Building. Tel 385 5188.

Safety Science
Ms B Littlewood, Administrative Assistant, Hut B, 11a, Room111. Tel 385 4144.

Textile Technology
Ms F Colville, Administrative Officer, Room 102, Sir Robert Webster Building. Tel 385 4477.

Wool and Animal Science Assoc.
Associate Professor J Kennedy, Room 256, Sir Robert Webster Building. Tel 385 4482.

Enrolment Procedures

All students re-enrolling in 1996 should obtain a copy of the free leaflet *ReEnrolling in 1996* available from School Offices and the Admissions Office. This leaflet provides detailed information on enrolment procedures and fees, enrolment timetables by Faculty and course, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Students With Disabilities

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

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

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

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

The Adviser can be contacted on 385 5418 or at Student Services, Quadrangle Building.

Equal Opportunity in Education Policy Statement

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

declares that it will not discriminate on the grounds of religious or political affiliations, views or beliefs.

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

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

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

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

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

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

Student Clubs and Societies

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

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

Applied Sciences Library Facilities

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

The Biomedical Library

The Biomedical Library provides library services for staff and students from the Faculties of Medicine and Biological and Behavioural Sciences, the Schools of Applied Bioscience, Health Services Management, Fibre Science and Technology, Food Science and Technology and the Department of Safety Science. It is closely associated with the teaching hospitals of the University.

The Biomedical Library is located on Levels 2, 3 and 4 of the Mathews Building Annexe and is connected to the other Special Libraries via a link through Level 3 of the Library Building.

Biomedical Library staff are available at the Information Desk on Level 2 Mathews Building to provide reference services and to assist in the use of the catalogues. Instructional classes in the use of the library and specific subject material can be arranged through the Information Desk.

Serials in the Biomedical Library are shelved in alphabetical order by title and carry the prefix MB or MBQ. Details about Biomedical Library books, serials and audiovisual material can be found in the Library Catalogue.

In addition the Biomedical Library offers the following services and facilities: literature searches; on-site and remote access to a wide range of bibliographic databases; and a document supply service for external and remote students.

Biomedical Librarian: Jill Denholm

The Physical Sciences Library

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

During the academic year the Library is open from 8.00 am to 10.00 pm Monday to Thursday, 8.00 am to 6.00 pm on

Friday and 12.00 pm to 5.00 pm Saturday and Sunday. During vacations, Library hours of opening will vary.

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

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

Physical Sciences Librarian: Rhonda Langford

Computing Requirements

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

Computing at UNSW

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

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

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

Conditions for the Award of the Degree of Bachelor of Science or Bachelor of Engineering

The courses leading to the award of the degree of Bachelor of Science or Bachelor of Engineering in the Faculty of Applied Science are progamd 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 or 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 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) in the Faculty of Applied Science are normally progamd 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.

General Education Program

UNSW requires that all undergraduate students undertake a structured program in general education as an integral part of studies for their degree. The University believes that a General Education complements the more specialised learning undertaken in a student's chosen field of study and contributes to the flexibility which graduates are increasingly required to demonstrate. Employers repeatedly point to the complex nature of the modern work environment and advise that they highly value graduates with the skills provided by a broad general education, as well as the specialised knowledge provided in more

narrowly defined degree programs. As well, over many years graduates of this University have reported that they greatly valued their General Education studies, which are found to be relevant to both career and personal development.

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

Objectives of the General Education Program

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

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

2. To enable students to evaluate arguments and information.

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

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

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

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

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

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

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

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

General Education requirements

The basic General Education requirements are the same for students in all courses:-

- Four (4) session length subjects carrying a minimum of 7.5 credit points each or their equivalent, in combinations of session length and year long subjects.
- An additional fifty-six (56) hours of study which foster 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.*

Each Faculty has responsibility for deciding what subjects are *not* able to be counted towards the General Education requirement for their students. In most cases, this means that subjects offered by the Faculty in which a student is enrolled, or subjects which are a required part of a course even though offered by another Faculty, are *not* able to be counted toward the General Education requirement.

Students should consult the General Education Handbook for detailed information about what subjects may and may not be taken to fulfil the General Education requirements for each course offered by the Faculty. The General Education Handbook is freely available from all Faculty Offices.

Additional information for undergraduate students who first enrolled before 1996

Transitional arrangements

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

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

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

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

The Faculty of Applied Science consists of the Schools of Applied Bioscience, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, Mines and the Centre for Petroleum Engineering. These Schools offer full-time undergraduate courses leading to the degree of Bachelor of Science or Bachelor of Engineering, and some of the Schools also offer part-time courses leading to the award of the degree of Bachelor of Science (Technology).

Computing Requirements

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

Full-time Courses

Full-time courses of four years' duration leading to the award of the degree of Bachelor of Science are offered in Applied Geography, Applied Geology, Biotechnology, Food Science and Technology, Industrial Chemistry, Textile Technology, Textile Management and Wool and Pastoral Sciences. Four year courses leading to the award of the degree of Bachelor of Engineering are offered in Bioprocess Engineering, Ceramic Engineering, Chemical Engineering, Mining Engineering and Petroleum Engineering. A four-year course leading to the award of a Bachelor of Metallurgical Engineering is offered in Metallurgical Engineering and a Bachelor of Materials Engineering is offered in Materials Engineering.

Honours: In all courses the degree may be awarded with Honours. The award of Honours is determined by performance in subjects and in the final-year project. Honours are awarded in Class 1; Class 2 Division 1; and Class 2 Division 2.

Industrial Training Requirements: In the scientific and technological courses close association with industry is maintained on the practical aspects of the professions. This is achieved in most of the courses of the Faculty by expecting students to complete an approved industrial training program prior to graduation. This is normally carried out during the Summer Recess. In the case of Wool and Pastoral Sciences, students are required to complete twenty-four weeks' approved practical work. In Mining Engineering students will undertake a program of practical training of at least 100 days.

Combined Degree Courses

A five-year combined degree course is available in Civil Engineering and Mining Engineering **3146.** Students initially enrol in Civil Engineering, and Mining Engineering subjects are taken in Year 4 and Year 5.

Because the first two years of the Petroleum Engineering course are identical to the first two years of the Chemical Engineering course, it is possible, upon completion of the Petroleum Engineering program, to obtain a double BE degree in Petroleum and Chemical Engineering **3046** with one additional year of study.

Part-time Courses

Six-year part-time courses leading to the award of the degree of Bachelor of Science (Technology) are offered by the Department of Food Science and Technology in the School of Applied Bioscience; in Industrial Chemistry by the School of Chemical Engineering and Industrial Chemistry; and in Metallurgy and Ceramics by the School of Materials Science and Engineering.

The BSc(Tech) degree courses 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 in the Faculty of Applied Science 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, Master of Engineering or Master of Applied Science, 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.

Enrolment Procedures

All students enrolling in graduate courses should obtain a copy of the free leaflet *ReEnrolling 1996 for Postgraduate Students* available from School Offices and the Admissions Office. This leaflet provides detailed information on enrolment procedures and fees, enrolment timetables by faculty and course, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Research Degrees

The Faculty provides facilities for students to proceed to the award of the higher degrees of Doctor of Philosophy, Master of Engineering, Master of Science, Master of Applied Science, Master of Safety Science, Master of Engineering Science, and Master of Environmental Studies. Courses leading to the award of a Graduate Diploma are also offered. The degree of Doctor of Science is awarded for a contribution of distinguished merit in the fields of science, engineering or applied science.

The degrees of Doctor of Philosophy, Master of Engineering and Master of Science are all awarded for research and require the preparation and submission of a thesis embodying the results of an original investigation or design. Candidates for the Doctorate of Philosophy are normally involved in at least three years work. The work for the award of a Master's degree may be completed in a minimum of one year, but normally requires two years of study for full-time students, and equivalent time for part-time students.

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

PhD

Applied Geology	**1000**
Biotechnology	**1036**
Chemical Engineering	**1010**
Food Science and Technology	**1031**
Geography	**1080**
Industrial Chemistry	**1016**
Materials Science and Engineering	**1045**
Mineral Processing and Extractive Metallurgy	**1046**
Mining Engineering	**1050**
Petroleum Engineering	**1017**
Safety Science	**1665**
Textile Technology	**1060**
Wool and Animal Science	**1071**

ME

Chemical Engineering	**2150**
Materials Science and Engineering	**2175**
Mining Engineering	**2180**
Petroleum Engineering	**2156**
Safety Science	**2695**

MSc

Applied Geology	**2000**
Biotechnology	**2036**
Chemical Engineering	**2010**
Food Science and Technology	**2031**
Geography	**2040**
Industrial Chemistry	**2016**
Materials Science and Engineering	**2055**
Mineral Processing and Extractive Metallurgy	**2046**
Mining Engineering	**2060**
Safety Science	**2775**
Textile Technology	**2070**
Wool and Animal Science	**2081**

Coursework Masters Degrees

The Faculty offers courses leading to the award of the degree of Master of Applied Science. The institution of this degree springs from the recognition of the considerable advance of knowledge in the fields of applied science and engineering which has marked recent years and the consequent increased scope for advanced formal instruction in these fields. Students are usually in attendance at the University for one year on a full-time basis or for two years part-time. Courses of study leading to the award of a Master of Applied Science degree may be undertaken in the Faculty as folows:

Biotechnology	**8042**
Biopharmaceuticals	**8043**
Corrosion Engineering	**8052**
Engineering Geology	**8022.1000**
Engineering Materials	**8065**
Environmental Management	**8047.3000**
Ergonomics	**8075**
Food Technology	**8032.1000**
Food Microbiology	**8032.2000**
Food Engineering	**8032.3000**
Fuel Technology	**8060**
Geographic Information Systems	**8027.1000**

Geological Data Processing	8022.3000
Groundwater Studies	8022.2000
Mining and Mineral Engineering	8055
Occupational Health and Safety	8044
Process Engineering	8016
Rangeland Management	8025
Remote Sensing	8047.2000

The Faculty offers a course leading to the award of the degree of Master of Environmental Studies **8045.** This is an interdisciplinary course designed to study the nature of environmental problems and the evaluation methodology. Students are usually in attendance at the University for one year on a full-time basis or for two years part-time.

The Master of Engineering Science course in Industrial Safety **8545** is flexible and designed for engineers who manage safety as part of their line management role or for specialist safety engineers who do not require the broad based MSafetySc course. Students are usually in attendance for one year full-time or for two years part-time.

The Master of Mining Management **8057** is designed to give mining personnel the opportunity to extend their career paths into management levels. Course work modules can be selected from Business Management and Science and Technology streams. Students are usually in attendance for two years on a part-time basis.

The Master of Safety Science course **8671** is a broad based course which gives a grounding in all the disciplines which are essential to safety, together with electives in specialist areas such as ergonomics, occupational hygene, safety management or safety engineering. Students are required to study for a minimum of eighteen months full-time or three years part-time.

Graduate Diplomas

Courses are also offered at the graduate level leading to the award of a Graduate Diploma. Students are required to attend courses of study for one year full-time or two years part-time.

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

Biotechnology	5015
Ergonomics	5485
Environmental Studies	5488
Food Technology	5020
Mining and Mineral Engineering	5040
Mining Management	5057
Petroleum Engineering	5031
Rangeland Management	5025
Remote Sensing	5047.2000
Safety Science	5480
Textile Technology	5090
Wool and Pastoral Sciences	5081

Candidates may register for all the research degrees subject to adequate research facilities and satisfactory supervision being available in the candidate's particular field of study. Where special conditions can be met the Faculty may grant permission to a candidate to enrol for the degree of Doctor of Philosophy on a part-time basis.

The conditions governing the award of the various higher degrees and graduate diplomas are set out later in this handbook in Conditions for the Award of Higher Degrees.

Short, intensive graduate and special courses are provided throughout each year designed to keep practising scientists and technologists in touch with the latest developments in their various fields.

MBT Program
Graduate School of Engineering

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

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

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

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

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

Subjects from the Industrial Management Qualification (IMQ), the first in the series of articulated courses of the MBT Program, complement those of the GMQ so that it is possible to use subjects from both to qualify for the Master's award. Candidates successfully completing four MBT subjects will have the option of either being awarded an IMQ or proceeding to the second level, the Graduate Diploma in Industrial Management course. Those successfully completing the requirements for the Graduate Diploma may be eligible to transfer to the Master of Business and Technology award course subject to approval by the Head, Graduate School of Engineering. In each case candidates electing to continue to the higher award will normally be required to pass at credit level assessment tasks already undertaken, and may be granted advanced standing in subjects not already taken for an award. It is anticipated that a candidate may require a

minimum of three years to complete all three levels of the MBT Program.

However, the time taken will depend upon a candidate's starting qualifications and attainment in the program. Special arrangements can be made to vary the normal route of progression subject to the approval of the Head of the Graduate School of Engineering. In order to fulfil the aims of the program candidates are normally expected to already have substantial industry experience. The subjects in the program are full-fee paying.

Further information can be obtained from Professor C Patterson, Head of the Graduate School of Engineering.

School of Applied Bioscience

Head of School
Professor PP Gray

Administrative Officer
Ms R Lee

The School of Applied Bioscience was formed in 1986 and consists of the Departments of Biotechnology and of Food Science and Technology. Previously these disciplines were separate Schools in the Faculties of Biological Sciences and Applied Science, respectively. The Department of Biotechnology retains membership of the Faculty of Biological and Behavioural Sciences. The academic relationship between biotechnology and food science and technology at UNSW is unique in Australia and offers opportunities for joint activities to further develop the food, beverage and pharmaceutical industries in this country.

Specialised centres exist in and are associated with each Department, and include the Bioengineering Centre, Food Industry Development Centre, Cooperative Research Centre for Biopharmaceutical Research and Cooperative Research Centre for Food Industry Innovation.

The School offers four undergraduate degrees and seven formal coursework postgraduate degrees or diplomas, as well as postgraduate MSc and PhD research degrees. Graduates of the School are keenly sought by industry and government employers. A number of Co-op Program, government and industry scholarships are available on a competitive basis for undergraduate and postgraduate studies.

The food and biotechnology industries have been targeted by government as key sectors for expansion with particular reference to exports and import replacement.

Department of Biotechnology

Head of Department
Professor PP Gray

Biotechnology can be defined as the use of various biological processes to make products and perform services. The essential feature of biotechnology therefore is the use of biological processes based on living cells and biochemical macromolecules such as proteins, DNA and RNA in a rapidly expanding range of activities of benefit to mankind. As such, biotechnology makes practical use of the recent scientific advances in areas such as molecular genetics.

The development of recombinant-DNA (r-DNA) technology has resulted in the ability to produce large quantities of any potentially useful product. Based on this technology, a new generation of biopharmaceuticals, including hormones, vaccines, anti-hypertensive and anti-inflammatory agents, are being developed which have the potential to revolutionise medicine. Microorganisms and viruses are being modified for use in controlling plant and animal diseases and pests. Diagnostic kits are being developed for use in forensic science and in product identification and quality control. In addition, genetic improvements in agriculture, plants and animals are becoming a reality, as is the control of inborn genetic disorders in humans.

Some aspects of biotechnology are traditional, having been used for centuries. The first makers of bread, cheese and fermented beverages over six thousand years ago were applying biotechnological principles in processing these goods. Without understanding the processes they were operating, they were in fact making use of catalysis mediated by microbial cells. Such processes are still in use today and scientific advances now allow for much greater control of the processes with resultant improvements in quality and economics of production. The number of such biological processes has also expanded and enzymes and/or microorganisms are used in the production of a wide

range of fermented foods (such as cheese, wine, beer, soy sauce, sauerkraut, yoghurt, kefir) and in the production of flavouring, colouring and sweetening agents.

Bioprocesses are also used in the extraction of minerals from low grade ores, and modified and novel bioprocesses are being developed for the treatment of waste and degradation of recalcitrant molecules, an area of vital importance in our increasingly polluted planet.

The future for expansion in all the above areas is immense, and an ability to cope with the problems of the 21st century will be heavily dependent on these advances.

The Department of Biotechnology offers undergraduate training in the BE Degree Course in Bioprocess Engineering, the BSc Degree Course in Biotechnology and in the BSc Degree Course through the Board of Studies in Science and Mathematics. The BE Course in Bioprocess Engineering is four years full-time and has been designed to meet the requirements for membership of the Institution of Engineers, Australia. The BSc (Biotechnology) Course is four years full-time and awarded with Honours to students who have distinguished themselves in coursework and in the final year project. The BSc Course through the BSSM is three years for a Pass degree during which the student can study aspects of biotechnology in combination with another major in a relevant discipline, preferably biochemistry, microbiology or chemistry. The fourth Honours Year of this BSc Course includes further formal training in biotechnology as well as an extensive research project. Details on both the Pass and Honours BSc Course majoring in biotechnology are given in the Faculty of Science Handbook.

Undergraduate Study

Course Outlines

3052
Biotechnology - Full-time Course

Bachelor of Science
BSc

This course in Biotechnology offers a comprehensive education in all aspects of modern applied biology. It leads to the award of a Bachelor of Science Degree over four years full-time study, with Honours for students who perform with merit.

Graduates in Biotechnology will be able to find employment in industries and other organisations involved with biopharmaceutical production and food processing, as well as in agricultural and environmental biotechnology.

		HPW S1	HPW S2	CP
Year 1				
BIOS1101	Evolutionary and Functional Biology	6	0	15
BIOS1201	Molecules, Cells and Genes	0	6	15
CHEM1002 or both	Chemistry 1	6	6	30
CHEM1101	Chemistry 1A and	6	0	15
CHEM1201	Chemistry 1B	0	6	15
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A *or*			
MATH1011	General Mathematics 1B	6	0	15
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B *or*			
MATH1021	General Mathematics 1C and an additional 2 level 1 units: recommended	0	6	15
PHYS1002	Physics 1 or			
PHYS1022	Introductory Physics 1 *or*			
Year 1 (cont)				
CHEN1020	Engineering 1CE	6	6	30

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

		HPW S1	HPW S2	CP
Year 2				
BIOC2101	Principles of Biochemistry	6	0	15
BIOC2201	Principles of Molecular Biology	0	6	15
BIOS2011	Evolutionary and Physiological Ecology	6	0	15
BIOS2021	Introductory Genetics	0	6	15
MICR2201	Introductory Microbiology	6	0	15
CHEM2021	Organic Chemistry *or*	6	0	15
CHEM2041	Chemical and Spectroscopic Analysis	0	6	15
plus 2 Level II units		6	6	30
General Education Subject(s)		2	2	15

Total HPW Session 1	**26**
Total HPW Session 2	**26**
Total Credit Points	**125**

Year 3				
BIOC3121	Molecular Biology of Nucleic Acids	6	0	15
BIOC3281	Recombinant-DNA Techniques and Eukaryotic Molecular Biology	0	6	15
BIOT3011	Biotechnology A	6	0	15
BIOT3061	Monoclonal Antibody and GeneticTechniques in Biotechnology	0	6	15
MICR3041	Immunology 1	6	0	15
MICR3071	Environmental Microbiology	0	6	15

		HPW S1	HPW S2	CP
Year 3 (cont)				
plus an additional 2 Level III units to be selected from the following:				
BIOC3111	Molecular Biology of Proteins	6	0	15
BIOC3271	Cellular Biochemistry and Control	0	6	15
MICR3051	Immunology 2	0	6	15
General Education Subject(s)		2	2	15
Total HPW Session 1	**26**			
Total HPW Session 2	**26**			
Total Credit Points	**135**			
Year 4				
BIOT3031	Microbial Genetics	6	0	15
BIOT3021	Biotechnology B	0	6	15
BIOT4053	Research Project	18	18	90
General Education Subject(s)		2	2	15
Total HPW Session 1	**26**			
Total HPW Session 2	**26**			
Total Credit Points	**135**			

3055
Bioprocess Engineering - Full-time Course

Bachelor of Engineering
BE

The first two years of the course are similar to the first two years of the Chemical Engineering degree course with the addition of basic training in Biology. The third year of the course contains basic training in Biochemistry, MicroEvolutionary Biology and Functional Biology well as the Chemical Engineering units and an introduction to Bioprocess Engineering which will be further developed in the fourth year. The course has been designed so that graduates can find employment in the fermentation, food processing, pharmaceutical, agro-industrial and waste treatment industries.

		HPW S1	HPW S2	CP
Year 1				
CHEM1002	Chemistry 1	6	6	30
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		2	2	15
Total HPW Session 1	**26**			
Total HPW Session 2	**26**			
Total Credit Points	**135**			
Year 2				
BIOS1011	Evolutionary and Functional Biology	6	0	15
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 Properties	1.5	0	4
CHEN2010	Materials 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
CHEN2051	Chemical Engineering Laboratory 1	3	2	12.5
ELEC0807	Electrical Engineering 1E	0	3	7.5
MATH2021	Mathematics 2	2	2	15
MATH2819	Statistics SA	2	2	10
General Education subject/s		2	2	15
Total HPW Session 1	**27**			
Total HPW Session 2	**25**			
Total Credit Points	**140.5**			
Year 3				
BIOC2101	Principles of Biochemistry	6	0	15
BIOC2201	Principles of Molecular Biology	0	6	15
BIOT3100	Fermentation Processes	0	2	5
CEIC3010	Reaction Engineering	0	3	7.5
CHEN3010	Engineering Thermodynamics	4	0	10
CHEN3020	Numerical Methods	0	3	7.5
CHEN3030	Fluids II	2	0	5
CHEN3040	Separation Processes	2	2	10
CHEN3050	Particle Mechanics	0	3	7.5
CHEN3060	Process Plant Engineering I	4	4	20
CHEN3070	Process Control	0	2	5
CHEN3080	Chemical Engineering Laboratory II	1.5	1.5	7.5
MICR2201	Introductory Microbiology	6	0	15
Total HPW Session 1	**25.5**			
Total HPW Session 2	**26.5**			
Total Credit Points	**130**			
Year 4				
APSE0002	Social Issues in Applied Science	2	0	5
BIOT4063	Research Project	2	10	30
BIOT4093	Biological Process Engineering	6	6	30
CHEN4030	Safety and Environment	2	0	5
CHEN4070	Process Dynamics and Control	3	2	12.5
CHEN4080	Design Project	1	4	12.5
CIVL0616	Structures	3	0	7.5
Total HPW Session 1	**25**			
Total HPW Session 2	**27**			
Total Credit Points	**102.5**			

Graduate Study

The Department of Biotechnology conducts formal courses leading to the award of Master of Applied Science degrees in Biotechnology and Biopharmaceuticals. A Graduate Diploma in Biotechnology is also available.

In addition, the Department welcomes enquiries from graduates in Chemistry, Biochemistry, Microbiology, Applied Science, Chemical Engineering, Physiology, Nutrition and Agriculture who are interested in pursuing research in biotechnology for the award of the degrees of Master of Science **2036** and Doctor of Philosophy **1036**.

The Head of Department provides information on research scholarships, fellowships, grants-in-aid and School research activities. Graduates are advised to consult the Head of School or Departments before making a formal application for registration.

Course Outlines

Master of Applied Science Degree Courses

The MAppSc degree courses provide for a comprehensive study of theoretical and applied aspects of the science, technology and engineering of foods. The courses are elective in nature providing an opportunity for graduates to apply their basic skills in areas relevant to these fields of applied science in which the Department has developed special expertise. Intending candidates are invited to contact the Head of Department for advice and recommendation.

The Department of Biotechnology offers two formal masters courses, the Master of Applied Science (Biotechnology) and the Master of Applied Science (Biopharmaceuticals)

8042
Master of Applied Science (Biotechnology)

MAppSc(Biotech)

The course includes advanced treatments of all areas of biotechnology. It is open to graduates with a four-year degree in biotechnology or a related discipline, or who have, in the opinion of the Higher Degree Committee, acquired equivalent qualifications or experience. Intending students are referred to Conditions for the Award of Graduate Degrees set out later in this handbook.

The course consists of lectures, tutorials, practical sessions, case history studies and a supervised project.

The minimum period of registration before the award of the degree is two sessions for full-time students and four sessions for part-time students.

An acceptable course would be a program of subjects involving a minimum of 18 hours per week for two sessions full-time or a minimum of 9 hours per week for four sessions part-time. Course details are as follows:

		HPW S1	HPW S2	CP
BIOT7043	Biotechnology Project Major	4	12	40
BIOT7051	Applied Genetics	0	5	12.5
BIOT7061	Peptide and Protein Technology	0	5	12.5
BIOT7071	Biochemical Engineering	0	5	12.5
BIOT7081	Environmental Biotechnology	5	0	12.5
BIOT7091	Applied Cellular Physiology	5	0	12.5
BIOT7100	Biological Principles	3	0	7.5
BIOT7110	Bioengineering Principles	3	0	7.5
BIOT7123	Biotechnology Project Minor	4	4	20

Total HPW Session 1 **25**
Total HPW Session 2 **26**
Total Credit Points **137.5**

Elective components

Elective subjects, including some undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval.

Each individual course must be approved by the Higher Degree Committee of the Faculty of Applied Science and would comprise:

1. A major strand of related material comprising approximately 75% of the total program, including a project comprising not less than 15% nor more than 50% of the program.

2. A minor strand of broader based material comprising up to 25% of the total program.

3. Undergraduate units may be included in one or both strands but may not exceed 25% of the non-project component.

4. At least 60% of the non-project component must be taken in the Department of Biotechnology unless otherwise approved by the Head of School. The remainder, subject to approval and availability, may be undertaken elsewhere in the University. Full details of all subjects are listed under Disciplines of the University in the Calendar.

8043
Master of Applied Science (Biopharmaceuticals)

MAppSc(Biopharmaceuticals)

This is an interdisciplinary program designed for graduates with backgrounds in either pharmacology or biotechnology who wish to obtain advanced training in both areas in order to gain expertise necessary for the development and use of the new generation of biopharmaceuticals which have been developed by, or result from, the application of molecular biology. It is open to graduates with a four year degree in a related discipline or who have, in the opinion of the Higher Degree Committee, acquired equivalent qualifications or experience. Prior study of biochemistry is required for the course. The course consists of lectures, tutorials, practical sessions, case history studies and a supervised project.The minimum period of registration before the award of the degree is two sessions for full-time students and four sessions for part-time students. The course is also offered through distance education. An acceptable course would be a program of subjects involving a minimum of 18 hours per week for two sessions full-time or a minimum of 9 hours per week for four sessions part-time. Choice of units is dependent on the background of the student.

Principles of Pharmacology (PHPH5461) must be taken by students who have not completed an approved Pharmacology course, while Principles of Biotechnology (BIOT7040)) must be taken by students who have not completed an approved Biotechnology course program.

All students must pass Advanced Pharmacology (PHPH5471) and Advanced Biotechnology (BIOT7030). Course details are as follows:

		HPW S1	HPW S2	CP
BIOT6070	Biopharmaceuticals Project (Minor) *or*	4	4	32
BIOT7050	Biopharmaceuticals Project (Major)	8	8	64
BIOT7030	Advanced Biotechnology	3	3	24
BIOT7040	Biotechnology Principles	6	2	32
PHPH5461	Pharmacology Principles	5	3	32
PHPH5471	Advanced Pharmacology	3	3	24
PHPH5481	Pharmacology Project (Major) *or*	8	8	64
PHPH5491	Pharmacology Project (Minor)	4	4	32

A recommended program for full-time students with a Biotechnology background would then be:

BIOT7030	Advanced Biotechnology	3	3	24
PHPH5461	Pharmacology Principles	5	3	32
PHPH5471	Advanced Pharmacology	3	3	24
BIOT7050	Biopharmaceuticals Project (Major) *or*	8	8	64
PHPH5481	Pharmacology Project (Major)	8	8	64

A recommended program for full-time students with a Pharmacology background would then be:

BIOT7030	Advanced Biotechnology	3	3	24
BIOT7040	Biotechnology Principles	6	2	32
PHPH5471	Advanced Pharmacology	3	3	24
BIOT7050	Biopharmaceuticals Project (Major)	8	8	64
PHPH5481	Pharmacology Project (Major)	8	8	64

Elective Components

If a minor project is selected, additional elective subject(s) may be selected from those offered by the Department of Biotechnology or the School of Physiology and Pharmacology, or from those offered by other Schools in the University subject to approval.

Each individual course must be approved by the Higher Degree Committee of the Faculty of Applied Science and would comprise: (i) a major strand of related material comprising approximately 75% of the total program including a project comprising not less that 15% of the program (ii) a minor strand of broader based material comprising up to 25% of the total program.

5015
Biotechnology Graduate Diploma Course

Graduate Diploma
GradDip

The graduate diploma course provides the opportunity for graduates with no previous tuition in biotechnology to undertake training in this discipline.

A degree in a science-based course is required for admission. If the degree course has not included a biology component, the candidate is required to undertake some basic biology training as a prerequisite or corequisite.

Under normal circumstances, students whose previous training has included a substantial component of biotechnology will not be admitted to the course.

The course comprises study of undergraduate and graduate formal subjects, plus extensive laboratory training in biotechnology.

The diploma is awarded after one year's full-time study, consisting of an average of 18 hours per week, or two years part-time study, consisting of an average of 9 hours per week. The program includes the listed obligatory subjects plus sufficient of the listed elective subjects to meet the hours of study required. The electives include subjects necessary for students without previous tuition in biochemistry and/or microbiology, as well as alternatives for those with previous tuition in these disciplines. The choice of electives in each individual case is subject to approval by the Head of School.

Compulsory Subjects

BIOT3011	Biotechnology A	6	0	15
BIOT3021	Biotechnology B	0	6	15
BIOT5013	Practical Biotechnology	6	6	30

		HPW S1	HPW S2	CP
Elective Subjects				
BIOT3031	Microbial Genetics	6	0	15
BIOT3061	Monoclonal Antibody and Genetic Techniques in Biotechnology	0	6	15
BIOT7100	Biological Principles	3	0	12
BIOT7110	Bioengineering Principles	3	0	12
BIOT8010	Graduate Seminars	2	2	8
MICR2011	Microbiology 1	0	6	15

Other suitable electives from the Department of Food Science and Technology and/or other Schools.

Department of Food Science and Technology

Head of Department
Professor KA Buckle

Food science and technology involves the understanding of basic sciences and the application of this knowledge to foods from the point of production, through handling, processing, preservation, distribution and marketing, up to consumption and utilisation by humans. It is concerned with food processes, food commodities, food composition and food quality (including sensory properties, safety and nutritional value).The study of food science and technology integrates many scientific disciplines. Its bases are in chemistry, physics, biochemistry and microbiology. Its borders merge with those of agriculture, engineering, human nutrition, public health, commerce, psychology and law. Biotechnology has a role of increasing importance in food science and technology.The food scientist and food technologist are concerned with population food supplies and requirements, community wants and needs, and equitable distribution of foods to ensure human nutritional needs are met. The food scientist and food technologist acquire new knowledge in the laboratory, the pilot plant, and the community, and apply it to the development of safe, nutritious and palatable foods, beverages and food ingredients by optimisation of processes and equipment. Foods are studied in terms of their basic constituents and structures, and the changes they undergo when subjected to handling, processing and distribution. The food scientist and food technologist are equally concerned with the development and selection of raw materials from agricultural, horticultural, animal and marine sources.

A safe, adequate, palatable and nutritious food supply is essential to human health. The food and beverage industry is of major economic importance and in Australia is the largest sector of manufacturing industry. Internationally, food production, processing and service are among the largest and most stable industries. The challenges are to increase the availability, variety, quality and quantity of foods economically and in line with the needs of the world population. The Australian industry has a major role to play in supplying high quality foods to emerging overseas markets. Thus there is a demand nationally and internationally for professionally trained people who are prepared to accept responsibility for the quality and safety of food.

The Department offers a four-year full-time course leading to the award of Bachelor of Science and a six-year part-time course leading to the award of the degree of Bachelor of Science (Technology). Graduates of both courses qualify for membership of the Australian Institute of Food Science and Technology, the US Institute of Food Technologists, and may qualify for membership of the Royal Australian Chemical Institute.

Graduate Diploma and Master of Applied Science courses in Food Science and Technology of one year full-time or two years part-time are designed for graduates in science or agriculture wishing to familiarise themselves with the principles of food science and technology. The Master of Applied Science course has three programs: Food Technology, Food Microbiology and Food Engineering.

The courses provide basic preparation for food science and technology careers in the food industry, the public sector, education, research, the food service industry, public health, management and marketing. Graduates may also find careers in health and environmental sciences, management of food resources and food wastes, and communication, and in areas such as dietetics after further training.

Undergraduate Study

Course Outlines

3060
Food Science and Technology - Full-time Course

Bachelor of Science
BSc

This course is designed to provide depth and breadth in the relevant physical and biological sciences on which food science and technology is based. Students completing the Year 1 requirements are eligible for selection for admission to Year 2 of the course. It is strongly recommended that students obtain, before the completion of the course and during recess periods, as much professionally oriented or industrial experience as possible.

		HPW S1	HPW S2	CP
Year 1				
BIOS1101	Evolutionary and Functional Biology	6	0	15
BIOS1201	Molecules, Cells and Genes	0	6	15
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
FOOD1100	Food in Society	2	0	5
MATH1141	Higher Mathematics 1A *or*			
MATH1131	Mathematics 1A *or*			
MATH1011	General Mathematics 1B	*6*	*0*	15
and				
MATH1241	Higher Mathematics 1B *or*			
MATH1231	Mathematics 1B *or*			
MATH1021	General Mathematics 1C	0	6	15
PHYS1002	Physics 1 *or*			
PHYS1022	Introductory Physics 1	6	6	30
Total HPW Session 1		**26**		
Total HPW Session 2		**24**		
Total Credit Points		**125**		

		HPW S1	HPW S2	CP
Year 2				
BIOC2101	Principles of Biochemistry	6	0	15
BIOC2201	Principles of Molecular Biology	0	6	15
CHEM2021	Organic Chemistry	5	1	15
CHEM2041	Chemical and Spectroscopic Analysis	0	6	15
CHEM2819	Physical Chemistry for Food and Fibre Science and Technology	0	6	15
FOOD3210	Introductory Nutrition	3	0	7.5
FOOD4210	Introductory Food Engineering	3	0	7.5
MATH2819	Statistics SA	2	2	10
MICR2218	Microbiology	6	2	20
Total HPW Session 1		**25**		
Total HPW Session 2		**23**		
Total Credit Points		**120**		

		HPW S1	HPW S2	CP
Year 3				
BIOT3041	Principles of Biotechnology	3	0	7.5
CHEM3926	Instrumental Methods of Food Analysis	0	3	7.5
CHEM3929	Food Chemistry	6	0	15
FOOD1310	Food Preservation	6	0	15
FOOD1320	Plant Food Science	2	0	5
FOOD1330	Animal Food Science	3	0	7.5
FOOD1340	Quality Evaluation and Control	0	2	5
FOOD1350	Food Technology Laboratory	0	6	15
FOOD2310	Food Microbiology	4	0	10
FOOD3310	Nutrition	0	3	7.5
FOOD4310	Food Process Engineering	0	4	10
FOOD4320	Computer Applications	0	2	5
General Education subject/s		0	4	15
Total HPW Session 1		**24**		
Total HPW Session 2		**24**		
Total Credit Points		**125**		

		HPW S1	HPW S2	CP
Year 4				
APSE0002	Social Issues in Applied Science	2	0	5
FOOD1400	Project	8	8	40
FOOD1410	Field Excursions	3	0	7.5
FOOD1420	Food Legislation	2	0	5
FOOD1430	Food Industry Management	2	0	5
General Education Subject/s		0	4	15
Plus three or more of the following electives to a total of not less than 45 credit points.				
FOOD1440	Food Quality and Product Development	0	6	15
FOOD1450	Food Processing Wastes	0	3	7.5
FOOD1460	Cereal Technology	0	6	15
FOOD1470	Postharvest Technology of Foods	6	0	15
FOOD2410	Advanced Food Microbiology	0	6	15
FOOD3410	Advanced Nutrition	6	0	15
FOOD4420	Food Packaging	3	0	7.5
FOOD4430	Advanced Food Engineering A	0	3	7.5
FOOD4440	Advanced Food Engineering B	0	3	7.5
Total Credit Points		**122.5**		

or such other electives to a total of not less than 45 credit points, as approved by the Head of Department. Year 4 totals at least 122.5 credit points.

During Years 3 and 4 of the course excursions are made to various food industries. Detailed reports of some of these visits are required.

Detailed reports of the students' activities during their periods in industry are required.

3065
Honours in Food Science
Full-time Course

Bachelor of Science (Honours)
BSc (Hons)

This course is designed to provide extensive research training in some aspects of food science and technology, at undergraduate level. The research orientation of the course, compared to the Graduate Diploma, facilitates entry into a research higher degree (MSc/PhD), upon completion of Honours at a satisfactory level.

Entry to the course requires satisfactory completion of a Bachelor degree, or equivalent, in an area considered relevant to food science and technology. Students who have completed a four-year Bachelor course, in which Honours has already been awarded, are specifically excluded.

The major component of the course is an extensive research project, conducted throughout one year of full time study. Candidates also take 10 credit points of subjects within the Department, or such other subjects as approved by the Head of Department, in each session, and complete a program of General Studies, dealing with social and ethical issues relevant to food science and technology. Honours is awarded on the basis of performance in the research project and satisfactory completion of coursework.

	HPW S1	HPW S2	CP
Compulsory Subjects			
FOOD9410 Honours Research Project	20	20	100
FOODXXXX*	2	2	10
General Studies	2	2	15
Total HPW Session 1	**24**		
Total HPW Session 2	**24**		
Total Credit Points	**125**		

**Subjects offered by the Department of Food Science and Technology or as approved by the Head of Department and dependent on the background of the candidate. Credits for coursework subjects may be concentrated in one session*

3070
Food Science and Technology
Part-time Course

Bachelor of Science (Technology)
BScTech

This course is designed for students who are employed in the food processing industries. It extends over six part-time years of study, and leads to the award of the degree of Bachelor of Science (Technology). Students are required to complete an approved program of industrial training of not less than twelve months 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 Department may be completed after completion of the prescribed course of study.

The course covers the same subject matter as the first three years of the full-time course. For the first two years students follow a common course in which general biology is taken, and thereafter specialise in the biological sciences, which are fundamental to the study of food science and technology. The subjects of Stages 4, 5 and 6 may be available only in day-time classes, and substantial day-time release from industry may be required. Students who have completed the requirements of this course and have qualified for the award of the degree of Bachelor of Science (Technology) may proceed to the award of the degree of Bachelor of Science by attending for one full-time year and completing the subjects listed in Year 4 of the full-time course. Students desiring to proceed to the award of a BSc degree must apply to the Head of the Department not later than 31 December of the year in which the sixth stage is completed.

		HPW S1	HPW S2	CP
Stages 1 and 2				
BIOS1101	Evolutionary and Functional Biology	6	0	15
BIOS1201	Molecules, Cells and Genes	0	6	15
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
FOOD1100	Food in Society	2	0	5
MATH1141	Higher Mathematics 1A *or*			
MATH1131	Mathematics 1A *or*			
MATH1011	General Mathematics 1B *and*	6	0	15
MATH1241	Higher Mathematics 1B or			
MATH1231	Mathematics 1B *or*			
MATH1021	General Mathematics 1C	0	6	15
PHYS1002	Physics 1 *or*			
PHYS1022	Introductory Physics 1	6	6	30
Total HPW Session 1	**26**			
Total HPW Session 2	**24**			
Total Credit Points	**125**			

Note: Physics and Mathematics are usually taken as Stage 1, the other subjects as Stage 2

Stage 3				
BIOC2101	Principles of Biochemistry	6	0	15
BIOC2201	Principles of Molecular Biology	0	6	15
CHEM2021	Physical Chemistry for Food and Fibre Science and Technology	5	1	15
CHEM2041	Chemical and Spectroscopic Analysis	0	6	15
Total HPW Session 1	**11**			
Total HPW Session 2	**13**			
Total Credit Points	**60**			

Stage 4

		HPW S1	HPW S2	CP
CHEM2819	Physical Chemistry for Food and Fibre Science and Technology	0	6	15
FOOD3210	Introductory Nutrition	3	0	7.5
FOOD4210	Introductory Food Engineering	3	0	7.5
MATH2819	Statistics SA	2	2	10
MICR2218	Microbiology	6	2	20

Total HPW Session 1 14
Total HPW Session 2 10
Total Credit Points 60

Stage 5

		HPW S1	HPW S2	CP
BIOT3041	Principles of Biotechnology	3	0	7.5
CHEM3929	Food Chemistry	6	0	15
FOOD2310	Food Microbiology	4	0	10
FOOD3310	Nutrition	0	3	7.5
FOOD4310	Food Process Engineering	0	4	10
FOOD4320	Computer Applications	0	2	5
General Education subject/s		0	4	15

Total HPW Session 1 13
Total HPW Session 2 13
Total Credit Points 70

Stage 6

		HPW S1	HPW S2	CP
CHEM3926	Instrumental Methods of Food Analysis	0	3	7.5
FOOD1310	Food Preservation	6	0	15
FOOD1320	Plant Food Science	2	0	5
FOOD1330	Animal Food Science	3	0	7.5
FOOD1340	Quality Evaluation and Control	0	2	5
FOOD1350	Food Technology Laboratory	0	6	15
General Education subject/s		2	2	15

Total HPW Session 1 13
Total HPW Session 2 13
Total Credit Points 70

Graduate Study

The Department of Food Science and Technology conducts formal courses leading to the award of Master of Applied Science degrees in Food Technology, Food Microbiology and Food Engineering and a Graduate Diplomas in Food Technology.

In addition, the Department welcomes enquiries from graduates in Chemistry, Biochemistry, Microbiology, Applied Science, Chemical Engineering, Physiology, Nutrition and Agriculture who are interested in pursuing research in food science and technology for the award of the degrees of Master of Science **2031** and Doctor of Philosophy **1031**.

The Head of Department provides information on research scholarships, fellowships, grants-in-aid and School research activities. Graduates are advised to consult the Head of Department before making a formal application for registration.

Course Outlines

Master of Applied Science Degree Courses

The MAppSc degree courses provide for a comprehensive study of theoretical and applied aspects of the science, technology and engineering of foods. The courses are elective in nature providing an opportunity for graduates to apply their basic skills in areas relevant to these fields of applied science in which the Department has developed special expertise. Intending candidates are invited to contact the Head of Department for advice and recommendation.

Graduate courses are available for Master of Applied Science degree programs in the following areas:

Food Technology Course	**8032.1000**
Food Microbiology Course	**8032.2000**
Food Engineering Course	**8032.3000**

Entry qualifications

A four-year Bachelor degree, honours degree or equivalent (e.g. three-year degree plus relevant employment experience) is the minimum requirement for admission to the courses.

Study programs

Students are required to complete a program of study totalling at least 126 credit points (3.5 credit points equals 1 hour of class contact per week for one session) made up of compulsory subjects, a compulsory project (either 21 or 42 or 63 credit points) and elective subjects. Students who have previously studied compulsory subjects or their equivalent may be granted an exemption by the Head of Department but the equivalent number of credits must be completed by taking other approved subjects. The degree will comprise one year of full-time study (normally two sessions of at least 63 credit points each) or two years of part-time study (normally four sessions of at least 31.5 credit points each), and would comprise:

1. A major strand of related material comprising approximately 75% of the total program, including a project comprising not less than 15% nor more than 50% of the program.

2. A minor strand of broader based material comprising up to 25% of the total program.

3. Undergraduate material may be included in one or both strands but may not exceed 25% of the non-project component.

4. At least 60% of the non-project component must be taken in the School of Applied Bioscience unless otherwise approved by the Head of Department. The remainder, subject to approval and availability, may be undertaken elsewhere in the University. Full details of all subjects are listed under Disciplines of the University in the Calendar.

8032.1000 Food Technology

Master of Applied Science MAppSc

The MAppSc course in Food Technology is particularly relevant to graduates in Agriculture, Applied Science and Science with principal interests in chemistry, biochemistry, microbiology, physiology, nutrition and engineering. This is a formal course consisting of core components (including a project), and an elective component that allows reasonable flexibility and a choice of subjects in food science and technology based on the candidate's background, subject to the availability of staff and resources.

The course comprises:

Compulsory Subjects		**CP***
FOOD1527	Principles of Food Preservation	**21**
FOOD1557	Food Technology Laboratory	**21**
FOOD1707	Seminar	**7**

Compulsory Project		CP
Either		
FOOD1717	Major Research Project	63
or		
FOOD1727	Research Project	42
or		
FOOD1737	Minor Project	21

** These credit points may be concentrated in one session.*

Elective Subjects
Elective subjects making up the remainder of the credits, including undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval by the Head of Department.

The work involved in the project must be embodied in a report and submitted in accordance with the requirements of the Faculty.

Depending on the candidate's background, enrolment in some of the above subjects may be accompanied by enrolment in related undergraduate subjects as prerequisites or corequisites. A particular subject may not necessarily be conducted in any one year.

8032.2000
Food Microbiology

Master of Applied Science
MAppSc

The MAppSc course in Food Microbiology is a program of study designed for graduates in Food Science, Food Technology, Microbiology, Biochemistry, Biotechnology or related disciplines who have an interest in microorganisms associated with foods. The course provides advanced training in all aspects of food microbiology as well as fundamental aspects of food science and technology.

Entry qualifications

A four year Bachelor degree, honours degree or equivalent involving some basic training in microbiology and biochemistry is the minimum requirement for admission to the course.

The course comprises:

Compulsory Subjects		CP*
FOOD2597	Food Microbiology Seminar	7
FOOD2517	Food Microbiology	14
FOOD2527	Microbiological Examination of Foods	21
FOOD2537	Microbiological Quality Assurance	7

Compulsory Project		
Either		
FOOD2617	Major Research Project in Food Microbiology	63
or		
FOOD2607	Food Microbiology Research Project	48
or		
FOOD2547	Food Microbiology Project	21

Elective Subjects		CP
FOOD1517	Chemistry, Biochemistry and Physics of Foods	10.5
FOOD1527	Principles of Food Preservation	21
FOOD2507	Introductory Microbiology	10.5
FOOD2557	Microbial Spoilage of Foods	3.5
FOOD2567	Foodborne Microorganisms of Public Health Significance	7
FOOD2577	Food and Beverage Fermentations	7
FOOD2587	Microorganisms as Food Processing Aids and Ingredients	3.5

or other subjects offered by the Departments of Food Science and Technology and of Biotechnology or other Schools subject to approval by the Head of Department.

** Credit points may be concentrated in one session.*

8032.3000
Food Engineering

Master of Applied Science
MAppSc

The MAppSc course in Food Engineering is a formal course designed for graduates in Engineering or related disciplines and who have an interest in the processing of biological resources for human consumption. The formal components of the course provide professional training at an advanced level in food engineering and food science. The studies in food engineering are designed to strengthen and broaden the engineering background of candidates and emphasise the use of fundamental principles in solving problems associated with food processing. Problem solving skills in engineering are developed further in a research project devoted to an area of food engineering.

The course comprises:

Compulsory Subjects		CP*
FOOD1707	Seminar	7
FOOD4557	Food Engineering Laboratory	10.5
FOOD4567	Food Engineering Field Work	10.5
FOOD4587	Advanced Food Engineering A	14
FOOD4597	Advanced Food Engineering B	14
FOOD4607	Packaging and Production	14

Compulsory Project		
Either		
FOOD1717	Major Research Project	63
or		
FOOD1727	Research Project	42
or		
FOOD1737	Minor Project	21

**Credit points may be concentrated in one session.*

Elective components
The elective subjects making up the remainder of the credits, including undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval by the Head of Department.

5020
Food Technology Graduate Diploma Course

Graduate Diploma
GradDip

The Graduate Diploma course is designed to provide professional training at an advanced level for graduates in Science, Applied Science or Engineering who have not had previous training in Food Technology.

Requirements are a first degree and, in some cases, the successful completion of assignments or examinations, as directed by the Head of Department.

The course is a blend of formal lectures and laboratory work at the undergraduate and graduate levels. The Graduate Diploma in Food Technology (GradDip) is awarded on the successful completion of one year of full-time study (at least119 credit points 3.5 credit points equals 1 hour of class contact per week for one session), or two years of part-time study (at least 59.5 credit points/year). It involves the following program:

Compulsory Subjects		CP*
FOOD1527	Principles of Food Preservation	21
FOOD1537	Plant Food Products	7
FOOD1547	Animal Food Products	10.5
FOOD1557	Food Technology Laboratory	21
FOOD2517	Food Microbiology	14

Students who have previously studied compulsory subjects or their equivalent at an acceptable level may be granted an exemption by the Head of Department but the equivalent number of credits must be completed by taking other approved subjects.

**Credit points may be concentrated in one session.*

Elective Subjects

The elective subjects making up the remainder of the credits, including undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval by the Head of Department. In all cases the hours devoted to graduate subjects constitute at least 50% of the total course hours.

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.

Units are offered separately subject to specified prerequisites as well as the restrictions on those units designed as bridging materials.

APSE0002
Social Issues in Applied Science
Staff Contact: Faculty Office
CP7.5 S1 L1 T1

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.

BIOT3011
Biotechnology A
Staff Contact: Dr D Glenn
CP15 S1 L3 T3
Prerequisite: BIOC2101 and BIOC2201

The basic principles involved in the operation of microbial processes on an industrial scale. Includes: the selection, maintenance and improvement of microorganisms; the influence of physical and chemical factors on the microbial environment; the control of environmental factors; the effects of operational patterns on batch and continuous flow cultivation; aeration and agitation; scale-up of microbial processes; air and media sterilisation; the harvesting, purification and standardization of products; the principles involved in microbial processes for chemical, pharmaceutical and food production, microbial waste treatment and environmental control. The laboratory component includes manipulation of microorganisms, laboratory-scale fermentor operation, microbial enzyme isolation, visits to industrial fermentation plants and industrial seminars.

BIOT3021
Biotechnology B
Staff Contact: Prof P Rogers
CP15 S2 L2 T4
Prerequisite: BIOT3011

Application of principles of biotechnology to the analysis and design of microbial processes of industrial relevance (antibiotics, microbial enzymes, single cell protein from carbohydrates and hydrocarbons, fermented foods and beverages, amino acids and vitamins, microbial polysaccharides, activated sludge and photosynthetic processes for waste treatment, microbial leaching of low-grade minerals). Emphasis on quantitative approach: mass and heat balance calculations, kinetic and thermodynamic analysis, detailed equipment design and specification, process design and layout, process simulation, plant location, application of optimisation techniques. The economics of microbial processes are considered and comparison made with alternative modes of production or treatment. The economics of agroindustry in Australia using microbial processes. Marketing of fermentation products, clinical trials required, legal constraints, patent rights. Technical and economic feasibility studies, and a design project.

BIOT3031
Microbial Genetics
Staff Contact: Dr F Foong
CP15 S1 L2 T4
Prerequisites: BIOS2011, BIOS2021, BIOC2101, BIOC2201 and MICR2011
Note/s: Excluded MICR3021.

This unit is suitable for students majoring in Microbiology, Biochemistry, Biotechnology or Genetics. It deals with major aspects of the genetics of bacteriophage, bacteria and yeast. Topics include plasmids and transposible genetic elements, gene transfer, mutagenesis and DNA repair, mutants, bacteriophage genetics, gene cloning (vectors, recombinant-DNA techniques) and genetics of nitrogen fixation.

BIOT3041
Principles of Biotechnology
Staff Contact: Dr D Glenn
CP7.5 S1 L3
Prerequisites: BIOC210, BIOC2201 and MICR2218

Lecture component of BIOT3011 Biotechnology A

BIOT3051
Biotechnology Laboratory
Staff Contact: Dr D Glenn
CP7.5 S1 T3
Prerequisite: BIOT3041

Laboratory component of BIOT3011 Biotechnology A and a project set within the department to complement the laboratory component.

BIOT3061
Monoclonal Antibody and Genetic Techniques in Biotechnology
Staff Contact: Dr S Mahler
CP15 S2 L2 T4
Prerequisite: BIOC2101 and BIOC2201

Recent developments in biotechnology have resulted in techniques which are widely applied in industrial, clinical, veterinary, agricultural and research laboratories. Many of these techniques have resulted from the development of monoclonal antibodies and the development of gene probes. The course includes: antibody structure; production of monoclonal antibodies, cell fusion, hybridoma selection, culture techniques, purification; analytical techniques employing monoclonal antibodies (RIA, ELISA); therapeutic application of antibodies, immunotoxins; gene probes; restriction fragment length polymorphisms (RFLP); gene probes for disease detection, identification of bacteria and viruses; forensic application of DNA fingerprinting. Tutorial and practical work to complement the lectures.

BIOT3100
Fermentation Processes
Staff Contact: Prof P Gray
CP 5 SS T2

Factors governing the use of microorganisms in industrial processes, including the selection, maintenance and improvement of microorganisms, the control of environmental factors, batch and continuous flow operational patterns, product recovery, process optimisation and waste disposal. Demonstrations of the operation and control of fermenter systems and of microbial process simulation.

BIOT4053
Research Project
Staff Contact: Dr F Foong
CP90 F T18

The experimental investigation of some aspects of biotechnology.

BIOT4063
Research Project
Staff Contact: Prof P Rogers
CP30 S1 T2 S2 T10

The experimental investigation of some aspects of bioprocess engineering.

BIOT4073/BIOT4083
Biotechnology Honours
Staff Contact: Prof N Dunn

CP120/60

Advanced formal training in selected areas of biotechnology and participation in one of the school's research projects.

BIOT4093
Biological Process Engineering
Staff Contact: Dr C Marquis
CP30 F L2 T4
Prerequisite: MICR2201

This course includes coursework material in bioprocess engineering principles, aspects of food engineering and modern biotechnology techniques. Also incorporated in this subject is a practical component. Bioprocess engineering principles covered include basic matabolic pathways, stoichiometry and kinetics of growth and product formations, heat balances, secondary metabolic productions and structural kinetic models, sterilisation, oxygen mass transfer, mixing, instrumentation, downstream processing, legal and ethical issued related to biotechnology products. Food engineering areas covered include the application of modelling techniques to drying and heat transfer. Modern biotechnology methods covered include a variety of methods to generate and characterise production of monoclonal antibodies including hybridoma production, recombinant methods and phage display of antibodies.

BIOT5013
Practical Biotechnology
Staff Contact: Department Office
CP30 F T6

Illustration, demonstration and operation of laboratory-scale and pilot-scale equipment. Visits to appropriate industries. Experimental project or critical review.

BIOT7010
Reading List in Biotechnology (Microbiology)
Staff Contact: Prof N Dunn
CP12 S1 or S2 T3

BIOT7020
Reading List in Biotechnology (Biochemistry)
Staff Contact: Prof N Dunn
CP12 S1 or S2 T3

BIOT7030
Advanced Biotechnology
Staff Contact: Dr F Foong
CP24 F HPW3
Co-requisite: PHPH5471

This course will cover the production and characterisation of biopharmaceuticals. Production involving chemical and enzymatic peptide synthesis, recombinant production in *E.coli*, yeast, baculovirus and mammalian cells and associated purification processes will be covered. Regulatory considerations important in the validation of fermentation and recovery processes, the purity of final product, and the design of facilities will also be covered. Patent issues relevant to such products and other aspects of licensing business considerations will be addressed, as will case studies of current production processes.

BIOT7040
Biotechnology Principles
Staff Contact: Dr S Mahler
CP32 S1 6 S2 2

This course is designed to provide students who have not previously studied biotechnology with sufficient training in the field to complete the MAppSc (Biopharmaceuticals). Aspects of the application of gene cloning techniques for the production of recombinant proteins from a range of host cells, growth, product formation and recovery of microbial products, bioreactor design and operation, monoclonal antibody and gene probe technology will be covered.

BIOT7043
Biotechnology Project (Major)
Staff Contact: Prof P Rogers
CP64 S1 T4 S2 T12

An experimental or technical investigation or design project in the field of biotechnology. As part of their project students must satisfactorily complete a training program in research techniques. Part-time students and students carrying out an approved project externally may substitute an appropriate, alternative teaching program.

BIOT7050
Biopharmaceuticals Project (Major)
Staff Contact: Dr S Mahler
CP64 F HPW 8

An experimental or technical investigation or design project in the general field of biotechnology.

BIOT7051
Applied Genetics
Staff Contact: Prof N Dunn
CP20 S2 L2 T3

Isolation of commercially useful microorganisms. Mutagenesis and the isolation of mutants of the following types: auxotrophs; catabolic mutants; feedback inhibition and repression resistance; constitutive; catabolite

repression resistance; resistance to antimicrobial agents and to viruses; extended enzyme substrate specificity; altered enzyme properties; changes in promoter and attenuator activity.

Techniques of genetic exchange: transformation; conjugation; transduction; cell fusion; sexual and parasexual cycles. The use of these techniques in strain construction.

Recombinant-DNA technology: plasmid and virus technology; cloning vectors for use in microorganisms, plant and animal cells. Strain construction using recDNA techniques. Properties of expression, excretion and genetic stability of constructs.

BIOT7060
Biopharmaceuticals Project (Minor)
Staff Contact: Dr S Mahler
CP32 F HPW 4

A small experimental or design project, or an extensive literature review and analysis of a selected topic in biotechnology.

BIOT7061
Peptide and Protein Technology
Staff Contact: Dr S Mahler
CP20 S2 L2 T3

Industrial scale production of enzymes, peptide hormones, antibodies including monoclonal antibodies, vaccines; regulation of synthesis by environmental control and genetic manipulation; recovery and downstream processing techniques; immobilisation by entrapment and binding.

Applications of proteins in medical therapy and diagnosis and as analytical tools including ELISA and affinity chromatography: applications of enzymes in the food and beverage industries.

BIOT7071
Biochemical Engineering
Staff Contact: Prof P Gray
CP20 S2 L2 T3

Design of bioreactors; range of biocatalysts from free enzymes to immobilised cells; heat and mass transfer, scale-up, economic feasibility studies as applied to bioprocesses; design of equipment and facilities for sterile operation and to meet recDNA guidelines; downstream processing, design and operation; instrumentation and control; use of computer-linked systems; mathematical simulation.

Detailed examples of bioprocesses including: amino acid production, single cell protein and liquid fuels, secondary metabolite production, growth and product formation of animal and plant tissue cultures. Patent and commercial aspects of bioprocesses.

BIOT7081
Environmental Biotechnology
Staff Contact: Dr J Madgwick
CP20 S1 L2 T3

Environmental Biotechnology examines the way microbes decompose chemically complex materials. Applications include the use of bacteria and fungi to detoxify wastes, converting them to usable substances. Prevention of biodeterioration of valuable materials is also an important area of study. Lectures cover biodegradation of minerals, metals, cellulosics, aromatics, hydrocarbons and wastewater treatment. Students present research reviews and conduct experimental projects.

BIOT7091
Applied Cellular Physiology
Staff Contact: Dr F Foong
CP20 S2 L2 T3

Elemental and molecular composition of cells; formulation of growth media; stoichiometry of growth processes and product formation; metabolic regulation; stringent response; mechanisms of metabolite uptake and product release; maintenance energy; thermodynamics of cellular growth and activities. Effect of mutation on cellular physiology; recombinant-DNA products. Fermentation processes: inoculum preparation, physiology of selected processes.

BIOT7100
Biological Principles
Staff Contact: Dr F Foong
CP12 S1 L3

A study of the characteristics of living systems. Biological molecules: carbohydrates, lipids, proteins and nucleic acids. Cell structure and function: prokaryotic and eukaryotic cells. Basic biochemistry: thermodynamics and catalysis of metabolism; catabolic and anabolic processes; properties of enzymes; DNA replication; protein synthesis. Comparative metabolism of viruses, bacteria, fungi, plants and animals. Metabolic regulation. Modes of nutrition and nutrient cycles. Reproduction and genetics: eukaryotic and prokaryotic systems; sexual and asexual reproduction; bacterial genetics; recombinant DNA technology. Basic plant biology; plant structure and function; transport. Invertebrate zoology, evolution and animal behaviour. Microorganisms of commercial significance. Biodeterioration and biodegradation.

BIOT7110
Bioengineering Principles
Staff Contact: Prof P Rogers
CP12 S1 L3

A subject designed to provide an introductory course for students in the MAppSc Biotech program who have not previously undertaken any bioengineering studies.

Steady state and differential balances as a basis for quantification of complex real systems. Concepts in rate processes and kinetic analysis with application to biological systems. Experimental determination of rate data. Correlation of simple lumped rate processes and simultaneous distributed processes and the concepts involved in dimensionless numbers.

Laminar and turbulent flow. The structure of homogeneous and boundary layer turbulence flow in pipes and channels. Mixing theory. Process vessel reactor models.

Fluid viscosity, Newtonian and non-Newtonian fluids, convective and molecular transport processes. Heat and mass transport, film coefficients. Film, boundary layer, penetration and surface renewal theories.

Quantification of complex systems. Empirical and mechanistic models in biological systems.

BIOT7123
Biotechnology Project (Minor)
Staff Contact: Department Office
CP32 F T4

A small experimental or design project, or an extensive literature review or analysis of a selected topic in biotechnology. As part of their project students must satisfactorily complete a training program in research techniques. Part-time students and students carrying out an approved project externally may substitute an appropriate, alternative training program.

BIOT8010
Graduate Seminars
Staff Contact: Department Office
CP8 F T2

FOOD1100
Food In Society
Staff Contact: Dr JE Paton
CP5 S1 L2

Introduction to principles of food production and consumption. Food in history, society, economics and politics. Development of the food industry into one of the largest industry sectors in Australia; nutritional, physiological and psychological roles of food; role of microbiology, biotechnology and technology in safe, nutritious, innovative food processing. Topical issues discussed include: food irradiation - risk or benefit?; genetic engineering and biotechnology - 'new' food sources; food additives - necessity or evil?; environmental impact of food processing; food choices and prejudices and food marketing and education - who should the consumer believe?

FOOD1310
Food Preservation
Staff Contact: Prof KA Buckle
CP15 S1 L3 T3
Prerequisites: BIOC2101, BIOC2201, CHEM2021, CHEM2041, CHEM2819, FOOD3210, FOOD4210, MICR2218

Introduction to food preservation; spoilage control by traditional and modern techniques. Technology of food preservation by heating, chilling and freezing, sun drying and dehydration. Use of salt, sugar, acid, chemical preservatives, ionising radiations, modified atmospheres in food preservation. Chemical and microbial stability of foods. Packaging requirements for preserved foods. Water relations of foods. An integrated program of laboratory and pilot plant exercises designed to illustrate the principles and procedures presented in the lecture course.

FOOD1320
Plant Food Science
Staff Contact: Dr CMC Yuen
CP5 S1 L2
Prerequisites: BIOC2101, BIOC2201, CHEM2021, CHEM2041, CHEM2819, FOOD3210, FOOD4210, MICR2218

Cereals: Structure, composition, properties and uses of cereal grains with emphasis on wheat; processing and technology of wheat and rice. *Sugars:* Sources, types, properties of sugars in foods; sugar milling and refining. *Fruit and vegetables*: Nutrient composition; principles of post-harvest physiology, storage and handling. *Lipids*: Sources and composition of fats and oils, methods of extraction and processing. *Non-microbial hazards in foods*: Minerals, proteins, acids, goitrogens, cyanogens, carcinogens; spices and flavours. *Plant protein*: Sources, composition, extraction and uses in foods with emphasis on soybean. *Tea, cocoa and coffee*: Production, composition and processing.

FOOD1330
Animal Food Science
Staff Contact: Dr JE Paton
CP7.5 S1 L3
Prerequisites: BIOC2101, BIOC2201, CHEM2021, CHEM2041, CHEM2819, FOOD3210, MICR2218

Nature and distribution of world animal food resources. *Meat*: Muscle structure, function, slaughter, conversion of muscle to meat; chemical, biochemical factors in postmortem glycolysis; meat microbiology; chilling, freezing, curing, processing of meat and meat-derived products; processing equipment; meat marketing systems; nutritional and sensory properties of meats. *Milk and dairy products*: Chemical, physical properties, microbiology of milk; technology of milk-derived products including cheese, fermented products, butter; frozen, chilled and dried milk-derived foods. *Marine products*: Nature and distribution of world fishery resources; teleostean and elasmobranch species, spoilage mechanisms, quality assessment; preservation by chilling, freezing, salting, drying, smoking, marinading and fermentation; fish meal and fish protein concentrate. *Egg products*: Structure and composition of the avian egg; changes during storage of whole eggs; egg quality assessment; functional properties of egg components; preservation of the intact egg; pulping, freezing and drying of whole egg pulp, yolk and albumen.

FOOD1340
Quality Evaluation and Control
Staff Contact: Dr M Filadelfi-Keszi
CP5 S2 L1 T1
Prerequisites: FOOD1310, FOOD1320, FOOD1330, FOOD2310, MATH2819

An introduction to food quality, its nature, assessment and control during handling, processing and storage; the use of objective and sensory methods of assessment; an introduction to HACCP, TTT and PPP concepts.

FOOD1350
Food Technology Laboratory
Staff Contact: Dr JE Paton
CP15 S2 T6
Prerequisites: FOOD1310, FOOD1320, FOOD1330, FOOD2310

A program of exercises integrating elements of the chemical, physical, sensory and microbiological analysis of foods and the impact of processing on these factors. The program is designed to demonstrate the application of laboratory methods to food systems. Ability to carry out test methods and to interpret results will be a major component in student assessment.

FOOD1400
Project
Staff Contact: Dr RH Driscoll
CP40 F T8
Prerequisite: Completion of Year 3 subjects

The student undertakes an individual project involving a literature survey, an experimental investigation, the preparation of a detailed report on a selected topic in food science and technology, and presentation of seminars on a literature review and experimental results.

FOOD1410
Field Excursions
Staff Contact: Prof KA Buckle
CP7.5 S1 T3
Prerequisite: Completion of Year 3 subjects

Inspection of food processing plants, growing areas and research stations in the Sydney metropolitan area, New South Wales and interstate.

FOOD1420
Food Legislation
Staff Contact: Prof KA Buckle
CP5 S1 L2
Prerequisite: Completion of Year 3 subjects

An overview of Federal and State regulations affecting the production, marketing, advertising and sale of foods. Food imports and exports. Mechanisms for development of food standards. Principles of approval and usage of food additives; toxicological evaluation of food additives. Codex standards. Implementation of food regulations. Regulatory aspects of new food biotechnologies.

FOOD1430
Food Industry Management
Staff Contact: Dr M Filadelfi-Keszi
CP5 S1 L2
Prerequisite: Completion of Year 3 subjects

An introduction to food industry management, accounting, finance, marketing, industrial relations and communication skills.

FOOD1440
Food Quality and Product Development
Staff Contact: Dr M Filadelfi-Keszi
CP15 S2 L2 T4
Prerequisite: Completion of Year 3 subjects

The steps involved in new product development; role of market research and advertising. Costing procedures, new product failure, case studies. Practical exercises in new food product development.

FOOD1450
Food Processing Wastes
Staff Contact: Prof KA Buckle
CP7.5 S2 L2 T1
Prerequisite: FOOD1350 or equivalent

Effects of waste discharges into the environment. Treatment of water for domestic and industrial applications; water reuse; process modifications for effluent reduction. Origin, composition, treatment, disposal and utilisation of wastes from food processing operations. Legal and economic aspects of waste disposal. Inspections of water and waste treatment plants.

FOOD1460
Cereal Technology
Staff Contact: A/Prof M Wootton
CP15 S2 L2 T4
Prerequisite: FOOD1350

A treatment in greater depth of the following topics dealt with in FOOD1320. Production, storage, marketing and quality of cereal grains; current trends in these areas. Technology of bread, biscuit, noodle and cake manufacture. Chemical, physical and biochemical interactions in wheat flour doughs; flour milling and assessment of flour quality. Cereal protein analysis, properties and behaviour. Wheat variety identification. Meat/cereal combinations. Cereal enzymes. Non-food uses of cereals. Preparation and uses of cereal protein, starches and lipids.

FOOD1470
Postharvest Technology of Foods
Staff Contact: Dr CMC Yuen
CP15 S1 L2 T4
Prerequisite: FOOD1350

Pre-harvest considerations. Postharvest physiology and biochemistry. Postharvest factors affecting quality. Methods of storage and handling. Marketing strategies for selected food commodities.

FOOD1507
Introductory Food Science
Staff Contact: Prof KA Buckle
CP7 S1 L1 S2 T1

An introduction to the history of food preservation and human nutrition. Current world food patterns, organisations and trade. Food development programs, regional and international agencies and activities. Parameters of food quality; food choice and social behaviour, food and society. Students present a seminar on aspects of food science in Session 2.

FOOD1517
Chemistry, Biochemistry and Physics of Foods
Staff Contact: Prof KA Buckle
CP10.5 S1 or S2 L2 T1

An introduction to the chemical, physical and biochemical properties of foods. Food proteins, lipids, carbohydrates, nucleic acids, vitamins, minerals, pigments. Food enzymes, main classes and factors affecting their activity. Food rheology and texture. Heat transfer in foods. Effect of processing upon the properties of foods. Basic techniques for the analysis of food components and properties.

FOOD1527
Principles of Food Preservation
Staff Contact: Prof KA Buckle
CP21 S1 L3 T3

Spoilage control by traditional and modern techniques. Technology of food preservation by heating, chilling and freezing, sun drying and dehydration, salt, sugar, acid, chemical preservatives, ionising radiations, modified atmospheres. Chemical and microbial stability of foods. Packaging requirements for preserved foods. An integrated program of laboratory and pilot plant exercises designed to illustrate the principles and procedures presented in the lecture course.

FOOD1537
Plant Food Products
Staff Contact: Dr CMC Yuen
CP7 S1 L2

Cereals: structure, composition, properties and uses of cereal grains with emphasis on wheat; processing and technology of wheat and rice. *Sugars*: sources, types, properties of sugars in foods; sugar milling and refining. *Fruit and vegetables*: nutrient composition; principles of post-harvest physiology, storage and handling. *Lipids*: sources and composition of fats and oils, methods of extraction and processing. *Non-microbial hazards in foods*: minerals, proteins, acids, goitrogens, cyanogens, carcinogens; spices and flavours. *Plant protein*: sources, composition, extraction and uses in foods with emphasis on soybean. *Tea, cocoa and coffee*: production, composition and processing.

FOOD1547
Animal Food Products
Staff Contact: Dr JE Paton
CP10.5 S1 L3

Nature and distribution of world animal food resources. *Meat*: muscle structure, function, slaughter, conversion of muscle to meat; chemical, biochemical factors in postmortem glycolysis; meat microbiology; chilling, freezing, curing, processing of meat and meat-derived products; processing equipment; meat marketing systems; nutritional and sensory properties of meats. *Milk and dairy products*: chemical, physical properties, microbiology of milk; technology of milk-derived products including cheese, fermented products, butter, frozen, chilled and dried milk-derived foods. *Marine products*: nature and distribution of world fishery resources; teleostean and elasmobranch species, spoilage mechanisms, quality assessment; preservation by chilling, freezing, salting, drying, smoking, marinading and fermentation; fish meal and fish protein concentrate. *Egg products*: structure and composition of the avian egg; changes during storage of whole eggs; egg quality assessment; functional properties of egg components; preservation of the intact egg; pulping, freezing and drying of whole egg pulp, yolk and albumen.

FOOD1557
Food Technology Laboratory
Staff Contact: Dr JE Paton
CP21 S2 T6
Prerequisite: FOOD1527, FOOD1537, FOOD1547 or their equivalent

A program of laboratory and pilot plant exercises integrating elements of the chemical, physical, sensory and microbiological analysis of foods and the impact of processing on these factors. The program is designed to demonstrate the application of laboratory methods to food systems.

FOOD1627
Technology of Cereal Products
Staff Contact: Dr J Arcot
CP7 S2 L2
Prerequisite: FOOD1537 or equivalent

World production of cereals: cultivation, diseases, harvesting and storage of cereal crops. Grain morphology and components, cereal quality, quality and yield improvements by breeding. Milling of wheat, flour types, flour testing, suitability for different purposes, flour component interactions in doughs, flour bleachers and dough improvers, baking technology. The use of non-wheat flours in bread and baked goods. Pasta products and breakfast cereals. Nutritional aspects of cereals. Starch-gluten separation, starch syrups. Malting, brewing, distilling and industrial alcohol production from cereals. Preparation, properties and uses of modified starches.

FOOD1637
Marine Products
Staff Contact: Prof KA Buckle
CP7 S2 L2
Prerequisite: FOOD1547 or equivalent

World fisheries, oceanographic factors and fish populations. Biochemistry and microbiology of growth, culture, harvesting and post-harvest handling. Cultivation of fish, molluscs, crustacea, modern and traditional methods. Biochemistry and microbiology of marine products in relation to freezing and preservation by the use of heat, chemicals and fermentation. Quality control parameters and fish inspection. Role of marine products in world nutrition. Possibilities for further exploitation of marine resources.

FOOD1647
Food Additives and Toxicology
Staff Contact: A/Prof M Wootton
CP7 S1 L2

Functions, modes of action of food additives, consequences of use, ethical and legislative considerations. National, State and international attitudes and standards. Principles of toxicological testing, the evaluation of results.

FOOD1657
Postharvest Physiology and Handling of Fruit and Vegetables
Staff Contact: Dr CMC Yuen
CP21S1 L1 T5
Pre or Corequisite: FOOD1537 or equivalent

Biochemistry and physiology of metabolism in fresh fruit and vegetables; respiration measurements as an index of metabolism, maturation and senescence; concept of climacteric and non-climacteric produce; physiological and metabolic changes occurring during ripening. Effect of temperature on metabolism; constraints of high and low temperatures; role of humidity control and water loss in quality maintenance; use of atmosphere control to delay senescence and ripening. Physiological disorders of stored produce; microorganisms of importance to post-harvest tissue; physical and chemical methods of control; post-harvest disinfestation and quarantine measures. Examination of current commercial storage and marketing operations.

FOOD1667
Postharvest Storage of Foods
Staff Contact: Dr CMC Yuen
CP21 S1 L2 T4
Prerequisite: FOOD1557 or equivalent

Pre-harvest considerations, post-harvest physiology and biochemistry, post-harvest factors affecting quality, methods of storage and handling, marketing strategies for selected food commodities.

FOOD1707
Seminar
Staff Contact: Dr CMC Yuen
C7 F T1

Students present material arising from literature and/or laboratory assignments and/or plant investigations in the food and related industries. Critical assessments are made of the results of research in food science and technology.

FOOD1717
Major Research Project
Staff Contact: Prof KA Buckle
CP63 F T9

A detailed investigation of a selected topic in food science and technology including submission of a project report.

FOOD1727
Research Project
Staff Contact: Prof KA Buckle
CP42 F T6

An investigation of an aspect of food science and technology and submission of a project report.

FOOD1737
Minor Project
Staff Contact: Prof KA Buckle
CP21 F T3

A study of an aspect of food science and technology and submission of a project report.

FOOD1747
Special Topics in Food Science and Technology
Staff Contact: Prof KA Buckle
CP21 S1 or S2 T6

An individually supervised program of investigation in specialised aspects of food science and technology not otherwise offered. Embraces a literature review, laboratory work and/or industrial liaison as may be appropriate. Available only to appropriately qualified students.

FOOD1757
Special Topics in Food Science and Technology
Staff Contact: Prof KA Buckle
CP10.5 S1 or S2 T3

An investigation similar to but shorter than that outlined in FOOD1747.

FOOD1767
Reading Assignment
Staff Contact: Prof KA Buckle
CP3.5 SS T1

A reading assignment in an area supporting candidates' major disciplines or commodity interests. Presentation of a seminar may be required.

FOOD2310
Food Microbiology
Staff Contact: A/Prof GH Fleet
CP10 S1 L2 T2
Prerequisite: MICR2218

A lecture and laboratory program on the ecology, biochemistry, isolation, enumeration and identification of bacteria, yeasts, fungi and viruses associated with foods and beverages. *Food spoilage*: specific food microorganism associations; taxonomy and biochemistry of major spoilage species; chemical and physical changes to food properties; control; spoilage of specific commodities. *Foodborne microbial disease*: foods as vectors of disease and food poisoning; statistics and epidemiology; ecology and taxonomy of food-borne pathogenic microorganisms; control and prevention by hygiene, microbiological standards and legislation. *Food fermentation*: microbial ecology and biochemistry of fermentations; fermentations of alcoholic beverages, bakery products, dairy products, meats, vegetables, cocoa beans, soy sauce; production of food ingredients and processing aids by fermentation. *Microbiological examination of foods*: sample preparation and sampling plans; sub-lethal injury; standard methods for determination of total plate counts, indicator organisms, food-borne pathogenic species, principal spoilage species. *Microbiological quality assurance*: specifications and standards; decision criteria; hazard analysis and critical control point (HACCP) concept; cleaning and sanitation.

FOOD2410
Advanced Food Microbiology
Staff Contact: A/Prof GH Fleet
CP15 S2 L2 T4
Prerequisite: FOOD2310

An advanced theoretical and practical treatment of the ecology, taxonomy, biochemistry and analytical technology of bacteria, yeasts, fungi and viruses associated with food spoilage, food-borne disease and food fermentations. Emphasis on: new developments in food microbiology; economic consequences of microorganisms in foods; exploitation of microorganisms in novel processes for the production of food ingredients and processing aids; new technologies for the detection of microorganisms in foods, including enzyme immunoassay, DNA probes, bioluminescence, impedance, epifluorescent filtration methods; practical problems associated with the microbiological analysis of foods and interpretation of data.

FOOD2420
Yeast Technology
Staff Contact: A/Prof GH Fleet
CP7.5S1 L2 T1
Prerequisite: FOOD2310
Note/s: Not offered in 1996

The ecological, taxonomic and biochemical fundamentals of yeasts. The role of yeasts in alcoholic fermentations: beer, wine, cider, distilled spirits. Baker's yeast production and the role of yeasts in baking. Yeast fermented foods. The spoilage of foods by yeasts. Yeasts and yeast extracts as food for animals and humans. Yeast enzymes in the food industry.

FOOD2507
Introductory Microbiology
Staff Contact: A/Prof GH Fleet
CP14 S1 L2 T2
Note/s: Not offered in 1996

This subject is designed as a prerequisite to FOOD2517 for students with very limited or no background in basic microbiology. It covers the fundamentals of microbial taxonomy, ecology, cytology and biochemistry and the basic technologies of microbial culture, isolation, enumeration and identification.

FOOD2517
Food Microbiology
Staff Contact: A/Prof GH Fleet
CP14 S1 L2 T2
Prerequisite: FOOD2507 or other introductory microbiology subject

A lecture and laboratory program on the ecology, biochemistry, isolation, enumeration and identification of bacteria, yeasts, fungi and viruses associated with foods and beverages. *Food spoilage*: specific food/ microorganism associations; taxonomy and biochemistry of major spoilage species; chemical and physical changes to food properties; control of spoilage of specific commodities. *Foodborne microbial disease*: foods as vectors of disease and food poisoning; statistics and epidemiology; ecology and taxonomy of food-borne pathogenic microorganisms; control and prevention by hygiene, microbiological standards and legislation. *Food fermentation*: microbial ecology and biochemistry of fermentations; fermentation of alcoholic beverages, bakery products, dairy products, meats, vegetables, cocoa beans, soy sauce; production of food ingredients and processing aids by fermentation. *Microbiological examination of foods*: sample preparation and sampling plans; sub-lethal injury; standard methods for determination of total plate counts, indicator organisms, food-borne pathogenic species, principal spoilage species. *Microbiological quality assurance*: specifications and standards; decision criteria; hazard analysis and critical control point (HACCP) concept; cleaning and sanitation.

FOOD2527
Microbiological Examination of Foods
Staff Contact: A/Prof GH Fleet
CP21 S2 L2 T4
Prerequisite: FOOD2517 or equivalent

Detailed lecture and laboratory consideration of standard methods and new methods and technologies for the analysis of bacteria, yeasts and fungi in foods. Rapid cultural methods; immunoassay, DNA-probe, impedance, bioluminescence, image analysis,epifluorescence (DEFT), Petrifilm, computer identification of microorganisms. Measurement of cleaning and sanitation effectiveness. Sampling considerations. Interpretation of microbiological data in reference to specifications, standards, spoilage and public health risk. Detection and enumeration of specific microorganisms using new technologies.

FOOD2537
Microbiological Quality Assurance
Staff Contact: Dr JM Cox
CP7 S1 L1 T1
Prerequisite: FOOD2507 or equivalent
Corequisite: FOOD2527

A theoretical and practical consideration of the management of microbiological quality assurance. HACCP. Cleaning and sanitation. Microbiological specifications and regulations. Local and international approaches to obtaining safe food. Management and quality assurance in the microbiology laboratory.

FOOD2547
Food Microbiology Project
Staff Contact: A/Prof GH Fleet
CP21 F T3
Prerequisite: FOOD2517

A study of an aspect of food microbiology and submission of a project report.

FOOD2557
Microbial Spoilage of Foods
Staff Contact: Dr JM Cox
CP3.5 S2 L1
Prerequisite: FOOD2517

Consideration of major microbial groups responsible for spoilage - yeasts, moulds, lactic acid bacteria, acetic acid bacteria, psychrotrophs, lipolytics, proteolytics. Specific commodity groups - meat, dairy and fish products, fruits, vegetables. Impact of processing technologies on food spoilage and extension of shelf-life; biochemical basis of spoilage defects, taints; predictive considerations.

FOOD2567
Foodborne Microorganisms of Public Health Significance
Staff Contact: Dr JM Cox
CP7 S2 L2
Prerequisite: FOOD2517
Corequisite: FOOD2527

An advanced treatment of the ecology, epidemiology, properties, pathogenicity, methods of analysis, economic significance and control of pathogenic microorganisms in foods. *Salmonella, Shigella, Escherichia coli, Vibrio* sp., *Staphylococcus aureus, Bacillus* sp., *Clostridium perfringens, Clostridium botulinum, Yersinia, Listeria, Campylobacter, Aeromonas, Klebsiella,* viruses, fungi.

FOOD2577
Food and Beverage Fermentations
Staff Contact: A/Prof GH Fleet
CP7 S2 L2
Prerequisite: FOOD2517

A detailed treatment of the microbial ecology, biochemistry, processing technology and quality parameters of fermented foods and beverages; cheese, yogurt, novel dairy products; meat sausages; bread, biscuit/cracker doughs; soybean products, soy sauce, tempe; traditional fermented products of Asia and Africa; vegetables; cocoa beans; alcoholic beverages, beer, wine, champagne, distilled spirit.

FOOD2587
Microorganisms as Food Processing Aids and Ingredients
Staff Contact: A/Prof GH Fleet
CP3.5 S2 L1
Prerequisite: FOOD2517

This subject interfaces with biotechnology and considers the use of microorganisms as primary sources of processing aids and ingredients for food processing. The microbial production of vitamins, flavouring agents, amino acids, enzymes, pigments, thickening agents, fats and oils, modified proteins, organic acids. Use of microbial species as biocontrol agents to extend shelflife, as agents to improve the nutritive and therapeutic value of foods, immobilised cell and cell reactor technologies for conducting food and beverage bioconversions.

FOOD2597
Food Microbiology Seminar
Staff Contact: Dr JM Cox
CP7 S1 T1 S2 T1

Students present material arising from literature and/or laboratory assignments and/or plant investigations in the area of food microbiology. Critical assessments are made of the results of research in food microbiology.

FOOD2607
Food Microbiology Research Project
Staff Contact: A/Prof GH Fleet
CP42 F T6

An investigation of an aspect of food microbiology including a literature survey, experimental work and submission of a project thesis.

FOOD2617
Major Research Project in Food Microbiology
Staff Contact: A/Prof GH Fleet
CP63 F T9

A detailed investigation of a selected topic in food microbiology involving a literature survey, experimental work and submission of a project thesis.

FOOD3210
Introductory Nutrition
Staff Contact: A/Prof H Greenfield
CP7.5 S1 L2 T1
Co or Prerequisite: BIOC2101, BIOC2201

Role of nutrients in human structure and function. Effects of diet on growth and body size. Food habits, beliefs and choice; dietary patterns. Assessment of nutritional status; anthropometry, dietary intake studies, use of dietary recommendations, food groups, tables of food composition.

FOOD3310
Nutrition
Staff Contact: A/Prof H Greenfield
CP7.5 S2 L2 T1
Prerequisites: BIOC2101, BIOC2201, FOOD3210

Nutritional needs of vulnerable groups: infants, pregnant and lactating women, the aged. Dietary intolerance, disorders related to the affluent diet including coronary heart disease, dental caries, diabetes, hypertension and cancer. Problems of under-nutrition including protein, energy, mineral and vitamin deficiencies. Physiological and nutritional aspects of dietary fibre, alcohol and food intolerance. Measurement of nutrient intake using computer systems, on individual and group bases.

FOOD3410
Advanced Nutrition
Staff Contact: A/Prof H Greenfield
CP15 S1 L1 T5
Prerequisite: FOOD3310 or equivalent

Principles of nutrient analysis of foods. Practical exercises in nutrient analysis using bench and instrumental techniques. Principles of quality assurance of nutrient analytical data, data scrutiny and data compilation for food composition databases.

FOOD3507
Introductory Nutrition
Staff Contact: A/Prof H Greenfield
CP10.5 S1 L2 T1

Role of nutrients in human structure and function. Effects of diet on growth and body size. Food habits, beliefs and choice; dietary patterns. Assessment of nutritional status; anthropometry, dietary intake studies, use of dietary recommendations, food groups, tables of food composition.

FOOD3517
Nutrition
Staff Contact: A/Prof H Greenfield
CP10.5 S2 L2 T1
Prerequisite: FOOD3507 or equivalent

Nutritional needs of vulnerable groups: infants, pregnant and lactating women, the aged. Dietary intolerance, disorders related to the affluent diet including coronary heart disease, dental caries, diabetes, hypertension and cancer. Problems of under-nutrition including protein, energy, mineral and vitamin deficiencies. Physiological and nutritional aspects of dietary fibre, alcohol and food intolerance. Measurement of nutrient intake using computer systems, on individual and group basis.

FOOD3527
Advanced Nutrition
Staff Contact: A/Prof H Greenfield
CP21 S1 L1 T5
Prerequisite: FOOD3517 or equivalent

Principles of nutrient analysis of foods. Practical exercises in nutrient analysis using bench and instrumental techniques. Principles of quality assurance of nutrient analytical data, data scrutiny and data compilation for food composition databases.

FOOD4210
Introductory Food Engineering
Staff Contact: Ms JL Paterson
CP7.5 S1 L2 T1
Prerequisites: PHYS1002 or PHYS1022 and MATH1141 and MATH1241 or MATH1131 and MATH1231 or MATH1042 or MATH1011 and MATH1021

Units and dimensions. System conversions. Material, momentum and energy balances. Steady state and transient heat transfer; insulation; heat exchangers. Solid and fluid rheology; viscosity; pumps; mixing.

FOOD4310
Food Process Engineering
Staff Contact: Dr RH Driscoll
CP10 S2 L2 T2
Prerequisite: FOOD4210

Refrigeration, freezing, chilling and thawing. Evaporation; dehydration. Extraction. Distillation. Extrusion. Comminution. Filtration and separation. Process control. Packaging.

FOOD4320
Computer Applications
Staff Contact: Dr RH Driscoll
CP5 S2 L1 T1
Prerequisite: MATH2819

Introduction to the DOS operating system and WINDOWS. The use of statistical, graphics and other program packages to solve problems in food science and technology.

FOOD4420
Food Packaging
Staff Contact: Ms JL Paterson
CP7.5 S1 L2 T1
Pre or Corequisite: FOOD1310

Chemical and physical properties of packaging materials. Interaction between package and food, selection and evaluation of packaging materials and systems, design, printing, computers, modified atmosphere, smart films.

FOOD4430
Advanced Food Engineering A
Staff Contact: Dr RH Driscoll
CP7.5 S2 L2 T1
Prerequisites: FOOD4210, FOOD4310

Extrusion of food products, membrane technology, refrigeration, chilling, freezing, thawing, tempering, cold room design, process control.

FOOD4440
Advanced Food Engineering B
Staff Contact: Dr RH Driscoll
CP7.5 S2 L2 T1
Prerequisites: FOOD4210, FOOD4310

Mechanical and chemical separation, evaporation, distillation, psychrometry, drying, dryers, mass/energy balances, calculation of drying time, commercial equipment, current drying research.

FOOD4507
Food Engineering Principles
Staff Contact: Ms JL Paterson
CP10.5 S2 L2 T1
Prerequisite: First year mathematics and physics or equivalents

Units and dimensions; system conversions; material, energy and momentum balance; steady state and transient heat transfer; insulation; heat exchangers; solid and fluid rheology; viscosity; pumps; mixing.

FOOD4517
Unit Operations in Food Engineering
Staff Contact: Dr RH Driscoll
CP14 S2 L2 T2
Prerequisite: FOOD4507 or equivalent

Refrigeration; freezing; chilling and thawing; evaporation; dehydration; extraction; distillation; extrusion; comminution; filtration and separation; process control; packaging.

FOOD4537
Computing in Food Science
Staff Contact: Dr RH Driscoll
CP7 S2 L1 T1
Prerequisite: An introductory statistics subject or equivalent

Introduction to the DOS operating system and WINDOWS. The use of statistical, graphics and other program packages to solve problems in food science and technology.

FOOD4557
Food Engineering Laboratory
Staff Contact: Ms JL Paterson
CP10.5 S2 T3
Prerequisite: FOOD4587

Laboratory and pilot plant exercises illustrating the principles and procedures involved in food processing and food quality assessment.

FOOD4567
Food Engineering Field Work
Staff Contact: Ms JL Paterson
CP10.5 S3 T1.5

Inspection of food processing factories, agricultural and food research establishments and food producing areas.

FOOD4587
Advanced Food Engineering A
Staff Contact: Dr RH Driscoll
CP14 S2 L3 T1
Corequisite: FOOD4517 or equivalent

Extrusion of food products, membrane technology, refrigeration, chilling, freezing, thawing, tempering, cold room design, process control, numerical techniques and modelling.

FOOD4597
Advanced Food Engineering B
Staff Contact: Dr RH Driscoll
CP14 S2 L3 T1
Corequisite: FOOD4517 or equivalent

Mechanical and chemical separation, evaporation, distillation, psychrometry, drying, dryers, mass/energy balances, calculation of drying time, commercial equipment, current drying research.

FOOD4607
Packaging and Production
Staff Contact: Ms JL Paterson
CP14 S1 L3 T1

Chemical and physical properties of package materials; interaction between package and food; selection and evaluation of packaging materials and systems; package design criteria; printing; computers in packaging; modified atmospheres. Corrosion; scale-up; waste engineering; CIP systems; plant design.

FOOD9410
Honours Research Project
Staff Contact: Dr JM Cox
CP100 S3

An extensive research project on some aspects of food science and technology, including preparation of a literature review, conduct of laboratory-based research, presentation of two seminars, and submission of a thesis based on the results of the research project. Candidates will undertake corequisite formal coursework as approved by the Head of Department.

School of Chemical Engineering and Industrial Chemistry

Head of School
Professor DL Trimm

Administrative Officer
Ms KM Mason

The School contains the Departments of Chemical Engineering and Industrial Chemistry which service undergraduate degree courses, and the Departments of Fuel Technology and Polymer Science and the Centre for Minerals Engineering in conjunction with the School of Mines and School of Materials Science and Engineering which offer professional electives in these degree courses. A professional elective in Biological Process Engineering is also available from the Department of Biotechnology.

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.

Fuel engineering is primarily concerned with the practical and economic applications of scientific knowledge and engineering experience to the production, processing and utilisation of fuels and energy.

Industrial Chemists are applied scientists, some of whom are engaged in solving problems in forefront reseach areas while others are responsible for the successful operations of Australia's 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 'x to the y'); 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 expected 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 Head of School.

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.

		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
ATH1131	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

		HPW S1	HPW S2	CP
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
CHEM2828	Organic and Inorganic Chemistry (for Chemical Engineers)	4	0	10
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	1	2	7.5
ELEC0807	Electrical Engineering1E	0	3	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 25
Total HPW Session 2 25
Total Credit Points 135.5

		HPW S1	HPW S2	CP
Year 3				
CEIC3010	Reaction Engineering	0	3	7.5
CHEN3010	Engineering Thermodynamics	4	0	10
CHEN3020	Numerical Methods	0	3	7.5
CHEN3030	Fluids 2	2	0	5
CHEN3040	Separation Processes 1	2	2	10
CHEN3050	Particle Mechanics	0	3	7.5
CHEN3060	Process Plant Engineering 1	4	4	20
CHEN3070	Process Control	0	2	5
CHEN3080	Chemical Engineering Laboratory 2	1.5	1.5	7.5
CHEN3090	Chemical Engineering Applications*	4	4	20
CIVL0616	Structures	3	0	7.5
MATH3021	Mathematics	2	2	15
General Education subject/s		2	0	7.5

Total HPW Session 1 24.5
Total HPW Session 2 24.5
Total Credit Points 130

		HPW S1	HPW S2	CP
Year 4				
APSE0002	Social Issues in Applied Science	2	0	7.5
CHEN4010	Separation Processes 2*	2	0	5
CHEN4020	Advanced Reaction Engineering*	2	0	5
CHEN4030	Safety and Environmental*	2	0	5
CHEN4070	Process Dynamics and Control	3	2	12.5
CHEN4081	Design Project	3	3	15
CHEN4090	Research Project*	2	10	30
CHEN4100	Professional Electives*	3	3	15
CHEN4110	Process Analysis and Synthesis	1.5	1.5	7.5
CHEN4120	Process Plant Management and Operations	3	3	15

Total HPW Session 1 **23.5**
Total HPW Session 2 **22.5**
Total Credit Points **117.5**

**Students taking the Fuel and Energy Engineering or Minerals Engineering Electives follow a modified Program described below under 'Main Electives'.*

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

Main Electives

Fuel and Energy Engineering
The Department of Fuel Technology offers a coherent professional elective in Fuel and Energy Engineering designed for those students interested in the application of fuel and energy technologies in industry, commerce, government, education or research and development. The Department is the only one of its kind in Australia and has a long history of teaching and research in the fuels and energy area. The elective covers the broad areas of properties, constitution, processing, conversion and utilisation of fuels. Topics include combustion science and engineering; radiation and flames; design and performance evaluation of fuel using plant such as furnaces, boilers and heat recovery appliances; coal and oil conversion processes; energy management and conservation; and progress in fuel science and fuel processing.

Students choosing this professional elective should take FUEL3010 Fuel and Energy Engineering 1 in Year 3 and CHEN4121 Process Plant Management and Safety, FUEL4010 Fuel and Energy Engineering 2 and FUEL4090 Fuel and Energy Engineering Project in Year 4. Part-time students should take these subjects at equivalent stages of the part-time degree. (See BE Chemical Engineering 3040 Degree structure for the subjects that the Fuel and Energy Engineering courses replace).

This elective may qualify graduates for membership of the Australian Institute of Energy and the Institute of Energy UK.

Year 3				
FUEL3010		4	4	20
Year 4				
CHEN4121		3	0	7.5
FUEL4010		9	4	32.5
FUEL4090		2	10	30

Minerals Engineering
Jointly by the School of Chemical Engineering and Industrial Chemistry and the School of Mines, the Minerals elective is offered to students who wish to obtain a basic training in preparation for a career in the mineral industry. The elective covers the areas of secondary treatment of mineral sources, from physical mineral processing to pyrometallurgy and hydrometallurgy. Topics include engineering principles and current plant practices in comminution, beneficiation, extraction, purification, product recovery and other pyrometallurgical operations currently used in the coal, heavy minerals, iron and steel, nonferrous, base and precious metal industries. Progress in mineral science and technology, mineral plant design and process evaluation are also parts of the elective. Students choosing this elective should take the required subjects listed in the table below for Years 3 and 4 in lieu of the following subjects: CHEN3090 Chemical Engineering Applications, CHEN4010 Separations 2, CHEN4020 Advanced Reaction Engineering, CHEN4030 Safety and Environmental, CHEN4100 Professional Electives and CHEN4120 Process Plant Management and Operations. This elective may qualify graduates for membership of the Australian Institute of Mining and Metallurgy.

		HPW S1	HPW S2	CP
Year 3				
MINE0130	Principles of Mining	2	0	8
MINE3101	Mineral Process Engineering C	2	2	10
MINP4010	Hydrometallurgical Processes	0	2	5
Year 4				
CHEN4121	Process Plant Management and Safety	2.5	2.2	12.5
GEOL5410	Mineralogy for Mineral Engineering	0	2	5
MATS9650	Pyrometallurgical Processes	0	2	5
MINP4020	Hydrometallurgy Practices	3	0	7.5
MINP4030	Hydrometallurgical Process Engineering	0	2	5
MINE4101	Mineral Processing Practices	2	0	5
MINE4401	Mine Waste Disposal and the Environment	0	2	5

3050
Chemical Engineering - Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

This course requires an approved program of twelve months of industrial training prior to the award of the degree.

		HPW S1	HPW S2	CP
Stage 1				
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
Total HPW Session 1	**12**			
Total HPW Session 2	**12**			
Total Credit Points	**60**			
Stage 2				
CHEN1020	Engineering 1CE	6	6	30
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
General Educaation subject/s		2	0	7.5
Total HPW Session 1	**14**			
Total HPW Session 2	**12**			
Total Credit Points	**67.5**			
Stage 3				
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
ELEC0807	Electrical Engineering 1E	0	3	7.5
INDC2050	Physical Processes Laboratory	2	0	5
MATH2021	Mathematics	2	2	15
MATH2819	Statistics SA	2	2	10
Total HPW Session 1	**14**			
Total HPW Session 2	**12**			
Total Credit Points	**70.5**			
Stage 4				
CHEM2828	Organic and Inorganic Chemistry	4	0	10
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 I	1	2	7.5
General Education subject/s		2	2	7.5
Total HPW Session 1	**11**			
Total HPW Session 2	**13**			
Total Credit Points	**57.5**			
Stage 5				
CHEN3010	Engineering Thermodynamics	4	0	10
CHEN3020	Numerical Methods	0	3	7.5
CHEN3050	Particle Mechanics	0	3	7.5
CHEN3090	Chemical Engineering Applications	4	4	20
MATH3021	Mathematics	2	2	15
Total HPW Session 1	**12**			
Total HPW Session 2	**12**			
Total Credit Points	**60**			

		HPW S1	HPW S2	CP
Stage 6				
CEIC3010	Reaction Engineering	0	3	7.5
CHEN3030	Fluids II	2	0	5
CHEN3040	Separation Process I	2	2	10
CHEN3060	Process Plant Engineering I	4	4	20
CHEN3070	Process Control	0	2	5
CHEN3080	Chemical Engineering Laboratory II	1.5	1.5	7.5
General Education subject/s		2	0	7.5
Total HPW Session 1	**11.5**			
Total HPW Session 2	**12.5**			
Total Credit Points	**62.5**			

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 as sufficient academic qualification for full corporate membership.

Various course patterns involving full-time and part-time study may be approved by the Head of School.

		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 *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
Total HPW Session 1	**24**			
Total HPW Session 2	**24**			
Total Credit Points	**120**			
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
CHEM2021	Organic Chemistry	2	4	15
CHEM2031	Inorganic Chemistry	0	6	15
INDC2010	Mass and Energy Balances	2	0	5
INDC2020	Introduction to Fluid Flow	2	1	7.5
INDC2030	Heat Transfer and Temperature Measurement	0	2	5
INDC2050	Physical Processes Laboratory	2	0	5

		HPW S1	HPW S2	CP
Year 2 (cont)				
MATH2021	Mathematics	2	2	15
MATH2819	Statistics SA	2	2	10
PHYS2920	Electronics	3	0	7.5
General Education subject/s		0	2	7.5

Total HPW Session 1 23
Total HPW Session 2 24
Total Credit Points 125.5

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
INDC3080	Instrumental Analysis 2	4	0	10
INDC3090	Chemistry of Industrial Processes	3	3	15
POLY3010	Polymer Science	2	4	15
General Education subject/s		2	2	15

Total HPW Session 1 25
Total HPW Session 2 23
Total Credit Points 125

Year 4				
APSE0002	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	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

3110
Industrial Chemistry - Part-time Course

Bachelor of Science (Technology)
BSc (Tech)

This course requires an approved program of 12 months of industrial training prior to the award of the degree.

		HPW S1	HPW S2	CP
Stages 1 and 2*				
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
INDC1020	Engineering 1 IC	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

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

**Physics and Mathematics are usually taken in Stage 1 and the other subjects in Stage 2.*

Stage 3				
CEIC2010	Instrumental Analysis	3	3	15
CEIC2030	Applied Thermodynamics and Rate Processes	2.5	0	6.5
CEIC2040	Applied Electrochemical and Surface Processes	1.5	0	4
INDC2050	Physical Processes 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 15
Total HPW Session 2 9
Total Credit Points 70.5

Stage 4				
CEIC2020	Computing	1	2	7.5
CHEM2021	Organic Chemistry	6	0	15
CHEM2031	Inorganic Chemistry	0	6	15
INDC2020	Introduction to Fluid Flow	2	0	5
INDC2010	Mass and Energy Balances	2	0	5
INDC2030	Heat Transfer and Temperature Measurement	0	2	5
PHYS2920	Electronics	3	0	7.5

Total HPW Session 1 14
Total HPW Session 2 9
Total Credit Points 60

Stage 5				
BIOT3100	Fermentation	2	0	5
CEIC3010	Reaction Engineering	0	3	7.5
CEIC4010	Process Economics 2	1	0	2.5
INDC3010	Thermodynamics	3	0	7.5
INDC3021	Numerical Methods	0	2	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
INDC3080	Instrumental Analysis 2	4	0	10
General Education subject/s		2	2	15

Total HPW Session 1 14
Total HPW Session 2 13
Total Credit Points 77.5

		HPW S1	HPW S2	CP
Stage 6				
CHEM3829	Organic Chemistry	6	0	15
INDC3070	Instrumentation and Process Control 1	0	3	7.5
INDC3090	Chemistry of Industrial Processes	3	3	15
POLY3010	Polymer Science	2	4	15

Total HPW Session 1 14
Total HPW Session 2 13
Total Credit Points 52.5

Graduate Study

Course Outlines

Formal courses in the School of Chemical Engineering and Industrial Chemistry lead to the award of the Master of Applied Science in Process Engineering **8016** or Fuel Technology **8060**.

The School welcomes enquiries from graduates interested in pursuing research. The following degrees are available:

PhD
Chemical Engineering **1010**
Industrial Engineering **1016**

MSc
Chemical Engineering **2010**
Industrial Engineering **2016**

ME
Chemical Engineering **2150**

Master of Applied Science Degree Courses

The MAppSc 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 student's approach, and the results must be embodied in a report and submitted in accordance with the University's requirements.

The following graduate courses are available to Master of Applied Science degree course candidates. Candidates may specialise in the following areas:

Process Engineering Course 8016
Fuel Technology Course 8060

Intending candidates are invited to submit proposed study programs to the Head of the School for advice and recommendation. Each individual course must be approved by the Higher Degree Committee of the Faculty of Applied Science. An acceptable course would be a program of formal study aggregating approximately 18 hours weekly for two sessions full-time or 9 hours weekly for four sessions part-time, and which could comprise:

1. A major strand of course material making up 75% of the total program. This includes a project constituting not less than 15% and not more than 30% of the program;

2. A minor strand of broader-based supporting material making up to 25% of the total program; and

3. Undergraduate material, which may be included in one or both strands but may not exceed 25% of the total program.

Approximately 60% of the program (including the project) must be undertaken in the School of Chemical Engineering and Industrial Chemistry. The remainder, subject to approval and availability, may be undertaken in other Schools within the University. Full details of all subjects are listed under Disciplines of the University in the Calendar.

Courses will be run in any year only if sufficient applications are received. A minimum number of 5 registrations is usually required.

8016
Process Engineering

Master of Applied Science
MAppSc

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. 36 credit points (30% of the course) can be taken as electives which will be given as one week intensive courses. A 36 credit point research project on relevant aspects of process industries, supervised by academic members of staff must be undertaken. Assessment of the project report will be undertaken by at least 2 staff members.

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

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

Core Subjects (12 credit points)

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

CEIC5320	Process Engineering Project

Elective Subjects (12 credit points)
three 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

8060
Fuel Technology

Master of Applied Science
MAppSc

This is a formal course leading to the award of the degree of Master of Applied Science. It is a two-year part-time course designed to provide professional training and specialisation in fuel science or fuel and energy engineering for graduates in science, applied science or engineering who have not had substantial previous formal education in these subjects. The course may be offered over 1 year full time with a sufficiently high enrolment.

The courses specialising in Fuel Technology is primarily intended for graduates in Applied Science, Engineering, or Science with principal interests in Chemistry, Mathematics and/or Physics. They are designed to allow the maximum flexibility consistent with the standing of the award.

The course is based on the general formula for a MAppSc degree program, whereby the subject FUEL3010 can comprise the undergraduate component, the project (30% or 15% of the program) is CEIC5000 or CEIC5010 and the remainder of the hours can be taken from the units offered in the FUEL58.. and FUEL59.. series of subjects. There are also compulsory seminar and laboratory practice subjects.

The course allows reasonable flexibility with a choice of subjects, and units within subjects, subject to the availability of staff. Provision is made for subjects outside those offered by the Department to be incorporated in the program at either graduate or undergraduate level.

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.

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.

APSE0002
Social Issues in Applied Science
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. Applictions of material balances to process calculations in chemical operations. Conventions in methods of analysis and measurement. Stoichiometry. Process calculations associated with gases and liquids. Problems involving bypass, recycle and purge. Differential material balances. Energy balances. Environmental engineering applications.

CEIC0020
Fluid/Solid Separation
Staff Contact: A/Prof JA Raper
CP5 SS L1.5 T5
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
CP16 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
CP12 S1 L2 T1
Prerequisites: CHEM1101, CHEM1201
Note/s: Servicing subject, i.e. a subject taught within courses offered by other faculties.

Provides esssential 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 fluoresence. 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: VAX computers, the VMS operating system and the EDT editor. The FORTRAN language Elementary numerical methods; library subprograms; structures of program modules for technical calculations. The BASIC language.

CEIC2030
Applied Thermodynamics and Rate Processes
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

Distinction between thermodynamic and kinetic control of processes. Definitions of classical thermodynamics. Open and closed systems. 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. The effect of temperature and concentration. The interaction of mass and heat transfer with chemical reaction rates. Laboratory kinetic measurements and their relevance to reactor design.

CEIC2040
Applied Electrochemical and Surface Processes
Staff Contact: A/Prof R Chaplin
CP4 S1 L1.5
Prerequisites: PHYS1002, CHEM1101and CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEN1020 or INDC1020

Electrochemical principles in the context of important industrial electrochemical processes and engineering. Electrolytes, their properties and applications. Industrial electrochemical processes, electrodes and cells. Surface phenomena. Gas-liquid, gas-solid, liquid-solid interfaces. Physical and chemical adsorption. Electrokinetic (zeta) potentials. The colloidal state. Sols, gels and emulsions in industrial processes.

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-adiabetic 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: Dr T Tran
CP2.5 S1 L1

Consists of the segment Process Economics CHEN3060 Process Plant Engineering 1

CEIC4020
Process Economics 2
Staff Contact: Dr 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: Dr C Dixon
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 C Dixon
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 C Dixon
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: A/Prof G Sergeant (Dept of Fuel Technology)
Staff Contact: A/Prof R Burford (Dept of Polymer Science)
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: A/Prof G Sergeant (Dept of Fuel Technology)
Staff Contact: A/Prof R Burford (Dept of Polymer Science)
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
CP36

An investigation of a problem in any area related to process engineering which involves a significant research component. Such an investigation should be related to the research interests and expertise of staff in the School of Chemical Engineering and Industrial Chemistry.

CEIC5321
Process Engineering Project
Staff Contact: A/Prof R Chaplin
CP36

An investigation of a problem in any area related to chemical process engineering which involves a substantial research component. This subject will also involve extensive training in research methods and techniques. The area of study would be related to the research interests of staff in the School of Chemical Engineering and Industrial Chemistry.

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 modles, 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: A/Prof J Raper
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 polymerization, ionic chain polymerization, Ziegler-Natta polymerization of olefins, step growth polymerization, production of polyesters, polyamides, polycarbonates and polyurethanes. Polymerisation Processes: bulk emulsion, solution and suspension polymerization of vinyl monomers, specialised techniques for ionic and coordination polymerisations, condensation polymerization.

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: A/Prof G Sergeant
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.

CHEN1010
Introduction to Chemical Engineering
Staff Contact: Dr D Wiley
CP10 F L1 T1

Introduction to the processing industry and chemical engineering practice. The role and responsibilities of the chemical engineer. Introduction to materials of construction for the processing industries. Application of process calculations in chemical process operations. Conventions in methods of analysis and measurement. The chemical equation and stoichoimetry. Introduction to material balancing. Process calculations associated with gases, vapours and liquids.

CHEN1020
Engineering 1 CE
Staff Contact: Dr C Dixon
CP30 S1 L2 T4 S2 L3 T3

This subject comprises CHEN1010 Introduction to Chemical Engineering, 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.

CHEN2010
Material and Energy Balances
Staff Contact: A/Prof M Brungs
CP10 F L1 T1
Prerequisites: CHEM1020, CHEN1020, 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. Shaft work and enthalpy. 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. Integrated Material and Energy balance problems. Students not taking CHEN1010 will be required to complete a 28-hour bridging course offered by the School early in Session 1.

CHEN2020
Flow of Fluids
Staff Contact: Dr R Amal
CP10 F L1 T1
Prerequisites: PHYS1002, CHEN1020, CHEM1101 and CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241

Units and dimensions. Fundamental concepts of Fluids. Simplification of the Navier-Stokes Equation: Fluid statics, continuity, Bernoulli's equation, momentum and energy equations. Flow in closed conduits, including laminar and turbulent flow and losses due to friction. Flow in open channels; hydraulic jump. Pumps and pumping; blowers and compressors, pipes and fittings. Measurement in Fluid Mechanics; viscosity, pressure, velocity, flowrate. Compressible flow.

CHEN2030
Heat Transfer
Staff Contact: Dr RPChhabra
CP7.5 S2 L2 T1
Prerequisites: PHYS1002, CHEN1020, CHEM1101 and CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241

Conduction: Steady state, one dimensional heat flow. Resistance concept, series and parallel. Unsteady state conduction. Convection: Laminar and turbulent flow. Analogies between Momentum and Heat Transfer. Correlations for flow in and across tubes and other surfaces. Free convection. Radiation: Black and grey bodies. Shape factors, reciprocity. Radiation from gases. Heat Transfer with phase change: Nucleate and film boiling. Condensation and effect of presence of inerts. Applications: Introduction to Heat Exchangers. Log mean temperature difference. Effectiveness - NTU relationships. Extended surfaces.

CHEN2040
Mass Transfer Fundamentals
Staff Contact: Dr A Adesina
CP5 S2 L1 T1
Prerequisites: PHYS1002, CHEM1101 and CHEM1201, CHEN1020, MATH1032 or MATH1231 or MATH1042 or MATH1241

An introduction to the significance of mass transfer to the chemical engineer. Topics to be covered include: mechanisms of mass transfer, mass transfer driving forces, molecular diffusion, mass transfer models, phase equilibrium. Discussion of application of mass transfer in the chemical process industries.

CHEN2051
Chemical Engineering Laboratory I
Staff Contact: Prof N Foster
CP12.5 S1 T3 S2 T2
Prerequisites: PHYS1002, CHEM1101 and CHEM1201, CHEN1020, MATH1032 or MATH1231 or MATH1042 or MATH1241

An introduction to laboratory work in chemical engineering including information retrieval techniques. Experiments designed to demonstrate physical processes in industrial situations.

CHEN3010
Engineering Thermodynamics
Staff Contact: Dr D Wiley
CP10 S1 HPW4
Co or Prerequisites: CEIC2030, CEIC2040, CHEN2010, CHEN2020

Review of first law of thermodynamics; thermochemistry; 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.

CHEN3020
Quantification of Chemical Processes
Staff Contact: Dr DC Dixon
CP7.5 S1 L1 S2 L1 T1
Prerequisites: CEIC2020, MATH2021, MATH2819

Basic concepts in process quantification. Solutions to chemical engineering applications by use of single and multiple, linear and non-linear, non-differential equations. Optimisation of chemical processes. Single and multiple dimensional search, linear programming, dynamic programming applications to process industry problems.

CHEN3030
Fluids 2
Staff Contact: Dr T Pham
CP5 S1 HPW2
Prerequisites: CEIC2020, CHEN2020, MATH2021

Single and Two-phase flow. Derivation of Navier-Stokes Equation and solutions for inviscid flow, boundary layer flow, non-Newtonian flow.

CHEN3040
Separation Processes 1
Staff Contact: Prof N Foster
CP10 F L1 T1
Prerequisites: CEIC2030, CEIC2040, CHEN2010, CHEN2020, CHEN2030, CHEN2040, CHEN2050

Stagewise Processes: Phase equilibrium. Absorption. Binary distillation. Liquid-liquid extraction. Design of Mass Transfer Equipment: Equipment design for absorption, distillation, liquid - liquid extraction and adsorption processes. Unit design for stagewise and differential contact. Design of equipment for membrane and other surface separation processes. Simultaneous Heat and Mass Transfer: Psychrometry. Cooling Towers. Drying.

CHEN3050
Particle Mechanics
Staff Contact: A/Prof J Raper
CP7.5 S2 L2 T1
Prerequisites: CEIC2020, CHEN2020, MATH2021, MATH2819

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, Carman-Kozeny, Ergun equations. Applications 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, conveyor belts and elevators.

CHEN3060
Process Plant Engineering 1
Staff Contact: Mr A Papagelis
CP20 F L3 T1
Prerequisites: CHEN2010, CHEN2020, CHEN2030, ELEC0802, MATH2021

Processing Engineering I: 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, process representation, process acquisition and licensing. Project Engineering I: Outline of scope of a process plant including plant location and layout, processing facilities and off-sites including utility system design, statutory regulations, facilities for storage, processing and transport of materials within the plant including design of piping systems. Process Equipment Design: Materials of construction. Procedures for the selection, design, specification and representation of process equipment. Pressure vessel and heat exchanger design. Engineering standards and procedures. Materials and Containment: The use and selection of metals, plastics, refractories, ceramics and glass in construction of chemical plants. Corrosion, strength of materials, use of codes and standards. Process Economics I: Capital and operating costs of a process plant. Fixed and variable costs. Break-even analysis. Cost estimation methods.

CHEN3061
Process Plant Engineering 1(Petroleum Engineering)
Staff Contact: Mr A Papagelis
CP17.5 S1 L3 S2 L3 T1
Prerequisites: CHEN2010, CHEN2020, CHEN2030, ELEC0802, MATH2021

Subject description as for CHEN3060

CHEN3070
Process Control
Staff Contact: Dr C Dixon
CP5 S2 L2
Prerequisites: CEIC2010, CEIC2020, MATH2021

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

CHEN3080
Chemical Engineering Laboratory 2
Staff Contact: Prof N Foster
CP7.5 F T1.5
Prerequisites: CHEM2828, CHEM2011, CEIC2010, CEIC2020, CHEN2010, CHEN2020, CHEN2030, CHEN2040, CHEN2050, MATH2021, MATH2819

An integrated chemical engineering laboratory incorporating experiments in fluid flow, heat transfer, mass transfer, thermodynamics and kinetics, instrumentation and process dynamics and control. The objectives of this laboratory are: to demonstrate, reinforce and extend the principles of chemical engineering which are covered elsewhere in the course; to introduce various laboratory techniques which are used in the experimental investigation of chemical engineering problems; to develop an interest in experimentation, and to develop a proficiency in technical report writing.

CHEN3090
Chemical Engineering Applications
Staff Contact: Dr C Dixon
CP20 F L2 T2
Prerequisites: CHEM2011, CEIC2020, CHEN2010, CHEN2020, CHEN2030, MATH2021, MATH2819

Application of chemical engineering principles to biochemical engineering, fuel engineering, solids handling, alumina and aluminium industries and polymer technology. Integrated problems illustrating skills in process analysis.

CHEN4010
Separation Processes 2
Staff Contact: Dr T Pham
CP5 S1 L1 T1
Prerequisite: CHEN3010, CHEN3020, CHEN3040, MATH3021

Separation of multi-component systems by stagewise operations. Muti-component separations using modern computer techniques. Phase equilibrium relationships for liquid-vapour and liquid-liquid systems. Azeotropic and extractive distillation.

CHEN4020
Advanced Reaction Engineering
Staff Contact: Dr A Adesina
CP5 S1 L1 T1
Prerequisites: CEIC3010, CHEN3020, CHEN3030, CHEN3040, MATH3021

Heterogeneous Systems: Kinetics of uncatalysed gas-solid and liquid-solid reactions. Kinetic models for catalytic reactions. Inter and intraparticle diffusional effects in fluid-solid systems. Design of fixed bed catalytic reactors in adiabatic and non-adiabatic and non-isothermal operation. Trickle bed reactors. Slurry reactors for batch and continuous operation. Laboratory reactors for determining kinetic parameters in heterogeneous systems.

CHEN4030
Safety and Environmental
Staff Contact: Prof A Fane
CP5 S1 L2
Prerequisites: CHEN3030, CHEN3040, CHEN3050, CHEN3060

Safety: Techniques for assessing safety of existing and proposed plants. Systems reliability, HAZOP and HAZAN. Pressure and explosion relief. Laboratory Safety. Pollution Control. 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 C Dixon
CP12.5 S1 L2 T1 S2 L1 T1
Prerequisites: CEIC3010, CHEN3020, CHEN3070, MATH3021

Common types of feedback controllers; translating control problems into block diagrams. Closed loop relationships and response; stability analysis for SISO systems; feedback controller tuning. Open and closed loop dynamic behaviour of systems of different order and how best to control these systems. Effect of dead time on control; introduction to dead time compensation. Introduction to cascade, feed forward and ratio control. Application of digital computers to real time control; interfacing computers with processes; distributed control systems; data acquisition and process monitoring; digital implementation of control algorithms. Introduction to multi-variable control.

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

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 institution's 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: Dr C Dixon
CP15 F L2 T1
Prerequisite: All Year 3 subjects

To be chosen from offerings in:
Advances in Computer-Aided Process Engineering; Polymer Engineering; Advanced Chemical Engineering Processes; Environmental Management for Chemical Engineers; Biochemical Engineering; Mineral Engineering and Advanced Process Control which will be offered by the relevant Schools or Departments.

CHEN4110
Process Analysis and Synthesis
Staff Contact: Mr AJ Papagelis
CP7.5 F L.5 T1
Prerequisite: CHEN3060,CHEN3070

Process diagnostics. Trouble shooting. Heat exchanger networks. Optimum energy utilisation methods.

CHEN4120
Process Plant Management and Operation
Staff Contact: A/Prof JA Raper
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.

CHEN4121
Process Plant Management and Safety
Staff Contact: Prof AG Fane
CP12.5 S1 L2.5 T2.5
Prerequisite: CHEN3030, CHEN3040, CHEN3050, CHEN3060

This subject is provided for those students taking the Fuel and Energy Engineering and Minerals Engineering electives. Comprises the Management component of CHEN4120 and the Safety component of CHEN4030.

FUEL0020
Fuels and Energy
Staff Contact: A/Prof G Sergeant
CP10 S2 L3 T1
Note/s: Servicing subject I.e. a subject taught within courses offered by other faculties.

A servicing subject for students in Electrical Engineering which covers the topics, sources and properties of fuels and energy, energy use patterns, principles of combustion, combustion calculations, the technology of boilers and other fuel plant, thermodynamic cycles, new and emerging energy technologies, including solar, wind and nuclear energy.

FUEL0040
Fuel Engineering for Ceramic Engineers
Staff Contact: A/Prof G Sergeant
CP5 F L1 or S1 L2

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

FUEL0050
Fuel and Energy Engineering for Process Metallurgy
Staff Contact: A/Prof G Sergeant
CP7.5 S1 L2 S2 L1

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

FUEL3010
Fuel and Energy Engineering 1
Staff Contact: A/Prof G Sergeant
CP20 F L3 T1

Sources, properties and classification of fuels and energy sources. Introduction to combustion engineering and science, the thermal design of furnaces, boilers and other fuel using plant, radiation. Basic principles of fuel processing,oil refining, gasification, liquefaction, carbonisation etc. Laboratory work on the properties of petroleum products, coal and gaseous fuels.

FUEL4010
Fuel and Energy Engineering 2
Staff Contact: A/Prof G Sergeant
CP32.5 S1 L5 T4 S2 L2 T2

Combustion engineering. Furnace and fuel plant design. Energy management. Technologies for the efficient use of fuel. Properties and evaluation of fuels for their application. Laboratory work on burners, furnaces, combustion, efficiency, etc.

FUEL4090
Fuel and Energy Research Project
Staff Contact: A/Prof G Sergeant
CP30 S1 T2 S2 T10

Investigation of some aspect of fuel engineering.

FUEL5800
Fuel Seminar
Staff Contact: A/Prof G Sergeant
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: A/Prof G Sergeant
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: A/Prof G Sergeant
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: A/Prof G Sergeant
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: A/Prof G Sergeant
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: A/Prof G Sergeant
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: A/Prof G Sergeant
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: A/Prof G Sergeant
CP12

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

FUEL5910
Atmospheric Pollution and Control (Theory)
Staff Contact: A/Prof G Sergeant
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: A/Prof G Sergeant
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 I
Staff Contact: Dr D Wiley
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 C Dixon
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 T2 S2 L1
Prerequisites: PHYS1002, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEM1101 and CHEM1201, INDC1020

Fundamental concepts of Fluids. Simplification of the Navier-Stokes Equation, continuity, Bernoulli's 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 Chhabra
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 Fourier's 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 Stefan's Law. Applications to industrial heat transfer equipment will be discussed.Temperature measurement devices and circuits. Pyrometry.

INDC2050
Physical Processes Laboratory
Staff Contact: Dr P Crisp
CP5 S1 T2
Prerequisites: PHYS1002 (or CHEM1101 and CHEM1201), CHEM1102, CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241, INDC1020

An integrated industrial chemistry laboratory incorporating a series of experiments designed to demonstrate the principles of physical processes and instrumentation in industrial situations.

INDC3010
Thermodynamics
Staff Contact: Dr D Wiley
CP7.5 S1 L2 T1
Co or 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.

INDC3021
Quantification of Industrial Chemistry Processes
Staff Contact: Dr AA Adesina
S2 L1 T1
Prerequisite: CEIC2020

Basic concepts in quantification of industrial processes. Applications of single and mulitple, linear and non-linear, non-differential equations to chemical processes.

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: Mr A Papagelis
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 exctraction, distillation, filtration, evaporation, centrifugation, drying and leaching operations, particle size reduction and enlargement.

INDC3070
Instrumentation and Process Control 1
Staff Contact: Dr C Dixon
CP7.5 S2 L2 T1
Prerequisites: MATH2021, CEIC2010, CEIC2020

Analog Computation: theory and application of basic analog computing elements; magnitude and time scaling; solution of linear differential equations. Instrumentation:

theory and application of transducers and transmitters for measurement of process variables. Process Dynamics: behaviour of linear, lumped paramater dynamics systems; first, second and higher order and integrating systems. Process Control closed loop, block diagrams, controllers and controller tuning.

INDC3080
Instrumental Analysis 2
Staff Contact: Dr P Crisp
CP10 S1 L2 T2
Prerequisite: CEIC2010

Theory and application of advanced instrumental techniques including: high performance liquid chromatography, infra-red spectroscopy, particle size analysis, surface area analysis, thermal analysis (TGA, DSC/DTA, DMA), ion chromatography, capillary gas chromatography.

INDC3090
Chemistry of Industrial Processes
Staff Contact: Dr T Davis
CP15 F L1 T2
Prerequisite: CEIC 2030, CEIC 2040
Corequisites CHEM2021, CHEM2031

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: Dr 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 MP Brungs
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: Dr DC Dixon
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: A/Prof R Burford
CP10 F T2

Students are required to deliver two lecturettes 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: A/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: Dr 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.

MINP4020
Hydrometallurgy Practices
Staff Contact: Dr T Tran
CP7.5 S1 L1 T2

A critical analysis of recent industrial and research development in hydrometallurgy, problems and methods available for research and development. Development of hydrometallurgical process flowsheets, elements of pre-feasibility studies. Selected laboratory exercises in mineral engineering to develop investigational skills for process development.

MINP4030
Hydrometallurgical Process Engineering
Staff Contact: Dr T Tran
CP5 S2 L2

Thermodynamic and kinetic principles in extraction, precipitation, adsorption. Thermodynamics and kinetics of electrochemical processes: cementation, hydrogen reduction, electrolysis. Design of reactors for hydrometallurgical and electrometallurgical processes.

POLY0010
Polymer Materials
Staff Contact: A/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: A/Prof R Burford
CP15 S1 L2 S2 Lab.4
Prerequisites: CHEM2011, CHEM2021, MATH2021, MATH2819
Co or Prerequisites: INDC3090

Polymerization chemistry and processes. Step and radical chain polymerization. Ionic (including stereoregular) polymerization. Methods including bulk, suspension, emulsion, solution and gas phase polymerisation. Industrially important polymers and their manufacture. Principles of analysis. Molecular weight distribution. Thermodynamics of polymer solutions. Polymer chain conformation. Viscoelasticity. Mechanical behaviour. Polymer morphology. Thermal behaviour and analysis. Chemistry and physics of elastomers. Elements of polymer compounding and fabrication. New polymers.

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

Selected topics from basic texts and the original literature covering polymer analysis: physics of glassy polymers, viscoelasticity, polymer rheology, polymer morphology fracture and environmental stress cracking, rubber elasticity, anionic cationic and Ziegler-Natta catalysis in polymer chemistry, emulsion polymerisation, silicon polymers and polymers for high temperature service.

POLY5000
Polymer Science
Staff Contact: A/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 Fibre Science and Technology

Head of School
Professor RE Griffith

Administrative Officer
Ms F Colville

The School of Fibre Science and Technology was established in 1986 to bring together the University's activities in Wool and Pastoral Sciences and Textile Technology. The objectives of the School include the provision of comprehensive education of undergraduate and postgraduate students in the science and technology of (i) production and marketing of wool fibre and other ruminant animal products, with special emphasis on wool fibre; (ii) production and marketing of other textile fibres; (iii) processing of textile fibres and their manufacture into consumer and industrial products; and (iv) performance and properties of textile and related fibre products.

These objectives are achieved by providing an undergraduate course in Wool and Pastoral Sciences which emphasises the plant and animal sciences relevant to production in the sheep industry, as well as preparation of wool for market, specification of wool, marketing of wool and the relationship between wool production and wool processing; and by providing undergraduate courses in Textile Technology (in which there are options in Textile Chemistry, Textile Engineering and Textile Physics) and Textile Management.

While Wool and Pastoral Sciences mainly deals with wool and similar fibres such as cashmere and mohair produced by goats, as well as more general features of animal production, Textile Technology covers all fibres and all aspects of their utilisation in consumer and industrial products.

Rapidly advancing developments in the primary and secondary fibre industries make close collaboration between workers from the production and processing sides essential. Many of these developments have been stimulated by objective measurement of fibre properties; a special area of expertise of the Department of Wool and Animal Science; and the objective specification of textile products in which the Department of Textile Technology is a world leader. In the sheep industry these developments have major implications for systems of wool production particularly in areas such as nutrition, genetics, breeding and management. The School provides a unique opportunity for integration of educational and research efforts right through from production of fibres to finished textile products. The School provides a stimulating environment for students who wish to make careers in fibre based rural and manufacturing industries, both of which are critically important in the economy of Australia.

The School of Fibre Science and Technology participates in the Co-operative Education Program. The program applies to all three undergraduate courses taught in the School. Students in the program will complete their degree in four years, with several supervised terms of industry employment spread throughout the course. Students participating in the program will receive financial support of $9,800 per annum for each of the four years of the progam. Selection into the program is based on high academic achievement and strong personal motivation for a successful career in the wool or textile manufacturing fields.

Department of Textile Technology

Head of Department
Professor MT Pailthorpe

Textile Technology is concerned with the conversion of both natural and man-made fibres into an extremely wide variety of finished products. These range from fabrics for apparel, soft furnishings, floor coverings and industrial use to such specialised textiles as tyre cord, ropes, protective clothing, sailcloth, parachute fabrics, medical dressings, composite materials, and many others.

In Australia, the Textile Industry has developed mainly in the past seventy years and today it is one of our largest manufacturing groups. As in overseas countries, the impact of science and technology is bringing rapid changes to the Industry, and a consequence of this has been a strong demand for personnel skilled in Textile Technology and Management.

The Department of Textile Technology offers courses in Textile Technology and Textile Management. Both courses extend over four years full-time study and lead to the award of the degree of Bachelor of Science. For the award of Honours, students need to have distinguished themselves in formal studies, laboratory exercises, and in their final year project. Graduates of both courses qualify for membership of the Textile Institute.

Students in both courses must complete a minimum of 40 working days approved industrial training, of which at least 30 working days training must be taken at the end of Year 3.

It is important to stress that the specialised nature of the training provided within the Department of Textile Technology does not mean a restricted range of job opportunities after graduation. Career possibilities extend through the textile industry, allied industries (such as the production of textile chemicals), private consultants, government departments and authorities, teaching at secondary and tertiary levels, and pure or applied research in various organisations.

Graduates may be employed in quality control, technical management, research and development, international trade, production or general management. Within the textile industry, graduates may, for example, enter any of the following areas; the manufacture of natural and or man-made fibres, yarns, fabrics, etc; dyeing, printing and finishing of textiles, quality assurance, marketing and retailing.

Undergraduate Study

Course Outlines

3170
Textile Technology - Full-time Course

Bachelor of Science
BSc

Textile Chemistry, Textile Physics, Textile Engineering Options

The conversion of textile raw materials into their finished products is simply a succession of, and an interaction between, a number of chemical, physical and engineering processes. It follows, therefore, that the disciplines involved in the study of textile technology, in addition to the technological aspects, include a study in depth of one of the following: chemistry, engineering or physics.

Graduates will qualify for membership for one of the following professional bodies: the Royal Australian Chemical Institute; the Institution of Engineers, Australia; or the Austalian Institute of Physics.

All students take a common first year, and they need not choose the option they desire to follow until the end of that year.

In Year 2 and Year 3 students specialise in one of three options of the course, viz. Textile Chemistry, Textile Physics or Textile Engineering. In Year 4 all students take the same subjects.

		HPW S1	HPW S2	CP
Year 1 All Options				
CHEM1101	Chemistry 1A, *and*	6	0	15
CHEM1201	Chemistry 1B	0	6	15
FIBR1101	Fibre Science 1	4	0	10
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 *or*			
PHYS1022	Physics for Health and Life Scientists*	6	6	30
TEXT1201	Introductory Textile Technology	0	4	10

Total HPW Session 1 22
Total HPW Session 2 22
Total Credit Points 110

**For admission into the Textile Physics or Textile Engineering options, students must complete the subject: PHYS1002.*

Textile Chemistry

		HPW S1	HPW S2	CP
Year 2				
CEIC2010	Instrumental Analysis	3	3	15
CHEM2021	Organic Chemistry	0	6	15
CHEM2819	Physical Chemistry for Food and Fibre Science	6	0	15
FIBR2201	Computing Applications	4	0	10
TEXT2101	Fibre Science 2	0	4	10
TEXT2201	Textile Statistics	0	2	5
TEXT2301	Yarn Technology 1	6	0	15
TEXT2401	Fabric Technology 1	0	6	15
General Education subject/s		2	2	15

Total HPW Session 1 21
Total HPW Session 2 23
Total Credit Points 115

Year 3				
CHEM3021	Organic Chemistry	6	0	15
Plus one of the following Chemistry electives				
CHEM2031	Inorganic Chemistry and Structure	0	6	15
or				
CHEM3121	Synthetic Organic Chemistry	0	6	15
or				
CHEM3321	Applied Organic Chemistry	6	0	15
or an alternative as approved by the Head of Department				
TEXT3602	Colouration Technology	0	4	10
TEXT3301	Yarn Technology 2	0	6	15
TEXT3401	Fabric Technology 2	6	0	15
TEXT3501	Finishing Technology A	4	0	10
TEXT3601	Colour Science	3	0	7.5
TEXT3101	Textile Structures 1	3	0	7.5
TEXT3801	Textile Engineering	0	3	7.5
General Education subject/s		2	2	15

Total HPW Session 1 24
Total HPW Session 2 21
Total Credit Points 117.5

Textile Physics

Year 2				
FIBR2201	Computing Applications	4	0	10
MATH2100	Vector Calculus	2.5	0	7.5
MATH2120	Mathematical Methods for Differential Equations	0	2.5	7.5
PHYS2001	Mechanics and Computational Physics	4	0	15
PHYS2011	Electromagnetism and Thermal Physics	0	4	15
PHYS2021	Quantum Physics and Relativity*	2	2	15
TEXT2101	Fibre Science 2	0	4	10
TEXT2201	Textile Statistics	0	2	5
TEXT2301	Yarn Technology 1	6	0	15
TEXT2401	Fabric Technology 1	0	6	15
General Education subject/s		2	2	15

Total HPW Session 1 20.5
Total HPW Session 2 22.5
Total Credit Points 130

**Note: because of prerequisite requirements students wishing to take certain year 3 electives may substitute PHYS2031 Laboratory in Year 2, and take PHYS2021 Quantum Physics and Relativity in Year 3.*

		HPW S1	HPW S2	CP
Year 3				
PHYS2031	Laboratory*	3	3	15
Plus Physics electives averaging not less then 3 hours per session, selected from the following:				
PHYS3021	Statistical Mechanics and Solid State Physics	4	0	15
PHYS3060	Advanced Optics	0	2	7.5
PHYS3110	Experimental Physics B1	4	0	7.5
PHYS3120	Experimental Physics B2	0	4	7.5
PHYS3410	Biophysics	0	2	7.5
PHYS3710	Advanced Laser and Optical Applications (offered odd numbered years only)	2	0	7.5
or an alternative as approved by the Head of Department				
TEXT3101	Textile Structures 1	3	0	7.5
TEXT3301	Yarn Technology 2	0	6	15
TEXT3401	Fabric Technology 2	6	0	15
TEXT3501	Finishing Technology A	4	0	10
TEXT3601	Colour Science	3	0	7.5
TEXT3602	Colouration Technology	0	4	10
TEXT3801	Textile Engineering	0	3	7.5
General Education subject/s		2	2	15

Total HPW Session 1 24
Total HPW Session 2 21
Total Credit Points 117.5

**See note for Year 2*

Textile Engineering

Year 2				
CIVL0616	Structures	3	0	7.5
ELEC0807	Electrical Engineering 1E	0	3	7.5
FIBR2201	Computing Applications	4	0	10
MATH2021	Mathematics	2	2	15
MECH1110	Graphical Analysis and Communication	0	3	7.5
MECH1300	Engineering Mechanics 1	4	0	10
TEXT2101	Fibre Science 2	0	4	10
TEXT2201	Textile Statistics	0	2	5
TEXT2301	Yarn Technology 1	6	0	15
TEXT2401	Fabric Technology 1	0	6	15
General Education subject/s		2	2	15

Total HPW Session 1 21
Total HPW Session 2 22
Total Credit Points 117.5

		HPW S1	HPW S2	CP
Year 3				
ELEC0808	Electrical Engineering 2E	0	3	7.5
MECH2300	Engineering Mechanics 2A	3	0	7.5
MECH2310	Engineering Mechanics 2B	0	2	5
MECH2600	Fluid Mechanics 1	2	2	10
MECH2700	Thermodynamics 1	2	2	10
TEXT3101	Textile Structures 1	3	0	7.5
TEXT3301	Yarn Technology 2	0	6	15
TEXT3401	Fabric Technology 2	6	0	15
TEXT3501	Finishing Technology A	4	0	10
TEXT3601	Colour Science	3	0	7.5
TEXT3602	Colouration Technology	0	4	10
General Education subject/s		0	4	15
Total HPW Session 1	**23**			
Total HPW Session 2	**23**			
Total Credit Points	**120**			
Year 4 (All Options)				
APSE0002	Social Issues in Applied Science	2	0	5
MANF0420	Production Management, *or*	6	0	15
TEXT4202	Textile Quality Control	0	2	5
TEXT4702	Textile Management*	6	0	15
TEXT4701	Textile Industry Studies	3	0	7.5
TEXT4003	Project	5	9	35
TEXT4013	Seminar	2	2	10
TEXT4101	Textile Structures 2	0	3	7.5
TEXT4201	Processing Laboratory	3	0	7.5
TEXT4501	Finishing Technology B	0	4	10
Total HPW Session 1	**21**			
Total HPW Session 2	**20**			
Total Credit Points	**102.5**			

**Co-Op Program students only.*

3175
Textile Management - Full-time Course

Bachelor of Science
BSc

The production and marketing of textile products involves a number of manufacturing processes, and requires an understanding of basic management principles. The Textile Management course provides a comprehensive knowledge of all the textile sciences and technologies. In addition the course includes studies in economics, accounting, marketing, management, and other areas of commerce.

The course is designed to meet the need for executives in the textile and allied industries. A wide choice of electives is available in the third year of the course. This allows students to either gain a broad knowledge of the various areas of commerce, or to specialise in one of the following areas: Applied Economics; Accounting and Financial Management; or Strategic Marketing Management.

		HPW S1	HPW S2	CP
Year 1				
CHEM1101	Chemistry 1A *or*			
CHEM1401	Introductory Chemistry A	6	0	15
ECON1101	Microeconomics 1 *or*			
ECON1103	Microeconomic Principles	3	0	15
ECON1102	Macroeconomics 1 *or*			
ECON1104	Macroeconomic Principles	0	3	15
FIBR1101	Fibre Science 1	4	0	10
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A *or*			
MATH1011	General Mathematics 1B	6	0	15
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B *or*			
MATH1021	General Mathematics 1C	0	6	15
PHYS1936	Physics 1 (Textile Management)	0	4	10
TEXT1101	Science for Textiles	0	2	5
TEXT1201	Introductory Textile Technology	0	4	10
Total HPW Session 1	**19**			
Total HPW Session 2	**19**			
Total Credit Points	**110**			
Year 2				
ACCT9001	Introduction to Accounting A	1.5	0	7.5
and				
ACCT9002	Introduction to Accounting B	0	1.5	7.5
and				
IROB1701	Industrial Relations 1A	3.5	0	15
and				
IROB2718	Human Resources Management	0	3	15
or				
ACCT1501	Accounting and Financial Management 1A	4	0	15
and				
ACCT1511	Accounting and Financial Management 1B	0	4	15
FIBR2201	Computing Applications	4	0	10
MARK2012	Marketing Fundamentals	4	0	15
MARK2052	Marketing Research	0	4	15
TEXT2101	Fibre Science 2	0	4	10
TEXT2201	Textile Statistics	0	2	5
TEXT2301	Yarn Technology 1	6	0	15
TEXT2401	Fabric Technology 1	0	6	15
General Education subject/s		2	2	15
Total HPW Session 1	**21**			
Total HPW Session 2	**22.5**			
Total Credit Points	**130**			
Year 3				
TEXT3101	Textile Structures 1	3	0	7.5
TEXT3301	Yarn Technology 2	0	6	15
TEXT3401	Fabric Technology 2	6	0	15
TEXT3501	Finishing Technology A	4	0	10
TEXT3601	Colour Science	3	0	7.5
TEXT3801	Textile Engineering	0	3	7.5
TEXT3602	Colouration Technology	0	4	10
Plus 2 Commerce electives selected from the following:				
ACCT2522	Accounting and Financial Management 2A	4	0	15

		HPW S1	HPW S2	CP
Year 3 (cont)				
ACCT2542	Accounting and Financial Management 2B	0	4	15
FINS2613	Business Finance 2A	3 or 3		15
IROB1701	Industrial Relations 1A	3.5	0	15
ECOH2301	Management Strategy and Business Development	3	0	15
ECON2103	Business and Government	0	3	15
ECON2104	Australian Macroeconomic Policy	3	0	15
INFS1602	Computer Information Systems 1	4 or 4		15
INFS2603	Computer Information Systems 2	0	4	15
LEGT7711	Legal Environment of Commerce	3 or 3		15
LEGT7731	Marketing and Distribution Law	0	3	15
MARK3043	International Marketing	0	3	15
MARK3073	Brand Management	4	0	15
MARK3083	Strategic Marketing Management	0	4	15
or an alternative as approved by the Head of Department				
General Education subject/s		0	4	15

Total HPW Session 1 19
Total HPW Session 2 20
Total Credit Points 117.5

		HPW S1	HPW S2	CP
Year 4				
APSE0002	Social Issues in Applied Science	2	0	5
MANF0420	Production Management *or*			
TEXT4702	Textile Management*	6	0	15
TEXT4701	Textile Industry Studies	3	0	7.5
TEXT4003	Project	5	9	35
TEXT4013	Seminar	2	2	10
TEXT4101	Textile Structures 2	0	3	7.5
TEXT4201	Processing Laboratory	3	0	7.5
TEXT4202	Textile Quality Control	0	2	5
TEXT4501	Finishing Technology B	0	4	10

Total HPW Session 1 21
Total HPW Session 2 20
Total Credit Points 102.5

**Co-Op Program students only*

Graduate Study

Course Outlines

Department of Textile Technology

The Department conducts a course which leads to the award of a Graduate Diploma in Textile Technology.

In addition, the Department welcomes inquiries from graduates in Science, Engineering and Applied Science who are interested in doing research leading to the award of the degrees of Master of Science **2070** or Doctor of Philosophy **1060**.

5090
Textile Technology Graduate Diploma Course

Graduate Diploma
GradDip

The course leading to the award of Graduate Diploma in Textile Technology is designed to prepare graduates for careers in the textile and allied industries. It also provides formal studies for graduates who are already employed in the textile industry. The normal requirement for admission to the course is a Bachelor degree or equivalent tertiary qualification.

The following program, which comprises both formal lectures and laboratory work, may be taken as a one year full-time course or two-year part-time course.

		HPW S1	HPW S2	CP
TEXT5001	Textile Technology Dissertation	1.5	1.5	**7.5**
TEXT5003	Textile Technology	1.5	1.5	**7.5**
TEXT5101	Fibre Science A	6	0	**15**
TEXT5102	Fibre Science B	0	4	**10**
TEXT5201	Textile Quality Control	0	2	**5**

Plus two electives per session (averaging not less than 9 hours per session), selected from the following:

TEXT5301	Yarn Technology A	5	0	**12.5**
TEXT5302	Yarn Technology B	0	5	**12.5**
TEXT5401	Fabric Technology A	0	5	**12.5**
TEXT5402	Fabric Technology B	5	0	**12.5**
TEXT5501	Finishing Technology A	5	0	**12.5**
TEXT5502	Finishing Technology B	0	5	**12.5**
TEXT5601	Colour Science	4	0	**10**
TEXT5602	Dyeing Technology	0	4	**10**

or an alternative as approved by the Head of Department

Candidates wishing to specialise in the theory and practice of yarn and fabric technology (engineering/physics orientation) should undertake the optional subjects TEXT5301, TEXT5302, TEXT5401 and TEXT5402. Candidates wishing to specialise in the science and technology of textile dyeing and finishing (chemistry orientation) should undertake the optional subjects TEXT5501, TEXT5502, TEXT5601 and TEXT5602.

Department of Wool and Animal Science

Head of Department
Associate Professor JP Kennedy

Agricultural products, particularly wool, still contribute a significant share of Australia's export income. The pastoral industry has also played a major role in the development of the continent and the largest single form of land use still is grazing by sheep and cattle.

Farming has advanced technologically in recent years. However, innovations are continually being sought to increase productivity, raise quality and improve marketing of rural products within the framework of local and international economics. There is a continual need for the feeding and clothing of humans on a planet with finite mineral and fuel resources. This challenge must be balanced with the need for conservation and careful manipulation of a pool of renewable living resources. Wool and pastoral scientists are required to research, communicate and administer the changes which are occurring.

Undergraduate Study

Course Outlines

The Department offers a full-time course of four years duration leading to the award of a Bachelor of Science degree at either Honours or Pass level. The course is the only one in Australia in which special emphasis is given to wool science. In addition, studies concentrate on the most important animal industries (sheep and cattle).

Students receive a thorough grounding in the appropriate basic scientific disciplines as well as the theory and application of principles which are relevant to all aspects of pastoral production, including production and utilisation of pastures; reproduction, nutrition, health, genetic improvement, ecology and management of grazing animals and the production, preparation for sale and specification of wool and meat. The course also includes study of the design and interpretation of experimental investigations, economics and business management as well as elective options on crop production, rangeland management and rural communications. Relevant subjects offered by other schools may also be included. An important component is the final year project whereby students engage in an area of personal research on a theoretical or experimental topic on which they are required to submit a thesis.

The course provides students with a broad overview of the pastoral industries. It aims to produce generalists rather than specialists and, although there is some scope for studying topics of special interest, the course is designed so that certain core subjects must be undertaken. Because of the broad education received, graduates are equipped for a wide variety of careers in, and associated with, agricultural production; including research, advisory work, education, marketing, management and administration. Graduates are eligible for corporate membership of the Australian Institute of Agricultural Science.

Industrial Training Requirements

1. Students are required to obtain twenty-four weeks practical experience on commercial properties. At least twenty weeks of experience must be obtained concurrently with the course, while up to four weeks may be allowed for practical experience obtained immediately prior to the commencement of the course.

2. Students are encouraged to obtain experience in a diversity of pastoral enterprises, i.e. cattle, sheep and cropping, in different climatic zones.

3. A maximum of eight weeks shall be allowed for practical experience on any one property, including home properties. Up to eight weeks employment at research or teaching institutions is allowed towards the industrial training requirement.

4. In order to obtain recognition for practical work carried out, students shall, within six weeks of the commencement of the session immediately following the period of employment:

(1) Submit written evidence from the owner or manager of the property or the director of the institution as to the length of employment.
(2) Submit a written report along the guidelines which are available from the Department.

3220
Wool and Pastoral Sciences - Full-time Course

Bachelor of Science
BSc

		HPW S1	HPW S2	CP
Year 1				
BIOS1101	Evolutionary and Functional Biology	6	0	15
BIOS1201	Molecules, Cells and Genes	0	6	15
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
FIBR1001	Natural Fibre Production	0	6	15
FIBR1101	Fibre Science 1	4	0	10
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A *or*			
MATH1011	General Mathematics 1B	6	0	15
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B *or*			
MATH1021	General Mathematics 1C	0	6	15
Total HPW Session 1	**22**			
Total HPW Session 2	**24**			
Total Credit Points	**115**			
Year 2				
CHEM2929	Fundamentals of Agricultural and Biological Chemistry	6	0	15
FIBR2201	Computing Applications	4	0	10
WOOL2103	Livestock Production 1	2	2	10
WOOL2203	Agronomy	3	6	22.5
WOOL2303	Agricultural Economics and Management	3	3	15
WOOL2503	Wool Science 1	3	3	15
WOOL2601	Animal Physiology 1	0	6	15
MATH2819	Statistics SA	2	2	10
General Education subject/s		2	2	15
Total HPW Session 1	**25**			
Total HPW Session 2	**24**			
Total Credit Points	**127.5**			
Year 3				
WOOL3203	Pastoral Agronomy	4	4	20
WOOL3401	Animal Nutrition	0	4	10
WOOL3503	Wool Science 2	3	3	15
WOOL3701	Animal Health and Welfare	3	0	7.5
WOOL3803	Genetics 1	3	3	15
WOOL3901	Biostatistics 1	4	0	10
BIOC2101	Principles of Biochemistry	6	0	15
BIOC2201	Principles of Molecular Biology	0	6	15
General Education subject/s		2	2	15

		HPW S1	HPW S2	CP
Year 3 (cont)				
Plus one of the five available options				
GEOG2021	Introduction to Remote Sensing	0	4	15
WOOL3111	Livestock Production 2	0	3	7.5
WOOL3211	Crop Agronomy*	0	3	7.5
WOOL3221	Range Management*	0	3	7.5
WOOL3511	Wool Marketing	0	3	7.5
WOOL3521	Wool Biology	0	6	15
Total HPW Session 1	**25**			
Total HPW Session 2	**25**			
Total Credit Points	**130**			

**Available in alternate years*

Year 4				
APSE0002	Social Issues in Applied Science	2	0	5
WOOL4003	Project	6	6	30
WOOL4013	Seminar	2	2	10

Plus at least 14 hours each session of optional subjects. Not more than one subject in each session may be chosen from Group B

Total HPW Session 1	**24**
Total HPW Session 2	**22**
Total Credit Points	**115**

Optional subjects

Group A				
WOOL3111	Livestock Production 2	0	3	7.5
WOOL3211	Crop Agronomy*	0	3	7.5
WOOL3221	Range Management*	0	3	7.5
WOOL3511	Wool Marketing	0	3	7.5
WOOL3521	Wool Biology	0	6	15
WOOL4113	Livestock Production 3	3	3	15
WOOL4413	Ruminant Nutrition	4	0	10
WOOL4513	Wool Science 3	4	4	20
WOOL4813	Genetics 2	4	4	20
WOOL4911	Biostatistics 2	0	4	10

Some subjects may not be offered in all years.

**Available in alternate years.*

Group B				
BIOS3061	Plant Ecosystem Processes	6	0	15
GEOG2021	Introduction to Remote Sensing	0	4	10
GEOG3032	Remote Sensing Applications	4	0	10
MICR2201	Introductory Microbiology	6	0	15

Or such other subjects as may be approved by the Head of Department.

Graduate Study

Course Outlines

The Department conducts a course which leads to the award of a Graduate Diploma in Wool and Pastoral Sciences.

In addition, the Department welcomes inquiries from graduates in Science, Agriculture and Applied Science who are interested in doing research leading to the award of the degrees of Master of Science **2081** or Doctor of Philosophy **1071.**

5081
Wool and Pastoral Sciences

Graduate Diploma
GradDip

The course leading to the award of the Graduate Diploma in Wool and Pastoral Sciences is specially designed for graduate students preparing themselves for careers in the pastoral industry. One of the principal functions of the course is to provide a bridge from other disciplines such as Agriculture, Veterinary Science and Pure Science for graduates who wish to study and work in the field of Wool and Pastoral Sciences, which is of such overall importance to Australia.

The normal requirement for admission to the course is a degree in Agriculture, Applied Science, Veterinary Science or Science in an appropriate field. In addition, students may be required to take a qualifying examination. Such qualifying examination will be of a standard which will ensure that the student has sufficient knowledge of the subject and the principles involved to profit by the course.

The following program may be completed in one year on a full-time basis. Students are required to carry out full-time study to the extent of eighteen hours lecture and laboratory work per week for two sessions. Both graduate subjects and undergraduate subjects may be chosen to suit the requirements of the student subject to their availability and the approval of the Head of the Department

Full-time Course

18 hours per week of which at least 10 must be chosen from:

		CP
WOOL5113	Livestock Production	48
WOOL5213	Range Management	12
WOOL5513	Wool Science	48
WOOL5813	Animal Breeding	32
WOOL5913	Quantitative Methods	32

A maximum of 8 hours per week of study may be selected from approved undergraduate subjects.

Graduate Diploma students are expected to work at the level of honours students in the undergraduate courses and to carry out prescribed study of current research material in the appropriate field.

Graduate Programs in Rangeland Management

The University has considerable experience of research and teaching relating to the management of arid zone rangelands, gained over many years by several of its schools. This experience is now used in the provision of these graduate programs based at the University campus in Kensington, Sydney, but also providing for the use of its field station resources including Fowlers Gap Arid Zone Research Station in western New South Wales.

Programs by coursework are available leading to the award of:

Master of Applied Science in Rangeland Management Course **8025**

Graduate Diploma in Rangeland Management Course **5025**

Entry qualifications. Masters degree course - Four-year degree at an appropriate standard in an appropriate discipline. Graduate Diploma course - Three-year degree from an approved university or qualifications deemed appropriate by the Faculty of Applied Science.

Course requirements. Candidates are required to complete a program totalling 120 credit points for the Masters degree or 96 credit points for the Graduate Diploma during one year of full-time study or two years of part-time study. Students will be expected to devote an additional 15 hours per week outside lectures to independent study, fieldwork and completion of assignments.

Course structure. All students are required to complete the core of compulsory subjects which for the Masters degree includes a 36 credit point Project. Students then complete the requirements for their Course by selecting the appropriate number of credits from the list of available subjects. Additional subjects may be selected with the permission of the Course Coordinator. In this way students have the flexibility to tailor the course to suit their individual needs.

8025
Rangeland Management

Master of Applied Science
MAppSc

Compulsory Subjects		CP
WOOL5213	Range Management	12
GEOG9320	Soil Degradation and Conservation	12
GEOG9509	Project or	36
WOOL5223	Project	36

Optional Subjects

Choose subjects totalling 60 credit points from the following list:

BIOS3014	Ecological Studies in Arid Lands Management	15
CIVL9875	Hydrological Processes	12
ECON2109	Economics of Natural Resources	15
GEOG9130	Soil Studies for Arid Lands Management	12
GEOG9150	Remote Sensing Applications	12
GEOG9240	Principles of Geographic Information Systems	12
GEOG9300	Vegetation Management	12
GEOG9310	River Management	12
WOOL5113	Livestock Production	48

Additional subjects may be substituted with the permission of the Head of Department.

5025
Rangeland Management

Graduate Diploma
GradDip

Compulsory Subjects		CP
GEOG9320	Soil Degradation and Conservation	12
WOOL5213	Range Management	12

Optional Subjects

Choose subjects totalling 72 credit points, to include at least 36 credit points of graduate level subjects.

CIVIL9875	Hydrological Processes	12
ECON2109	Economics of Natural Resources*	15
GEOG2021	Introduction to Remote Sensing*	15
GEOG3021	Biogeography*	15
GEOG3051	Soils and Landforms*	15
GEOG3062	Environmental Change*	15
GEOG9130	Soil Studies for Arid Lands Management	12
GEOG9240	Principles of Geographic Information Systems	12
GEOG9300	Vegetation Management	12
GEOG9310	River Management	12
WOOL2103	Livestock Production 1*	10
WOOL3111	Livestock Production 2*	7.5
WOOL3203	Pastoral Agronomy*	20
WOOL4113	Livestock Production 3*	15
WOOL5113	Livestock Production	48

**Undergraduate level subjects. Additional subjects may be substituted with the permission of the Head of Department.*

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.

Students should note that enrolment in all later year subjects taught by the School is subject to satisfactory course progression and approval of the Head of the Department.

APSE0002
Social Issues in Applied Science
Staff Contact: Prof Jean Cross
CP5 S1 L1 T1

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.

FIBR1001
Natural Fibre Production
Staff Contact: A/Prof David Cottle
CP15 S2 L3 T3

Introduction to the world and Australian wool and cotton industries; fibre and skin biology; mechanisms of, and factors affecting, fibre growth and morphology; introduction to wool and cotton production, harvesting, preparation for sale; wool types and marketing.

FIBR1101
Fibre Science 1
Staff Contact: Dr Shantha David
CP10 S1 L2 T2

Fibre classification and raw materials. Polymer requirements for fibre formation. Introduction to fibre structure and morphology. Physical and chemical properties of textile fibres. Production of natural and man-made fibres. Necessary and desirable attributes of textile fibres. Fibre mechanical properties, structure and physical properties of wool keratin. Laboratory classes on fibre identification and fibre microscopy.

FIBR2201
Computing Applications
Staff Contact: A/Prof John James
CP10 S1 L2 T2

Introduction to hardware and software concepts; operating systems. Introduction to computer programming: simple algorithms and data organisation. Computer applications in fibre science and technology: computer-aided design and manufacture CAD CAM; process monitoring and control, computer-integrated manufacture CIM; data acquisition; modelling and optimisation techniques; databases, spreadsheets, text word processing.

TEXT1101
Science for Textiles
Staff Contact: Dr Shantha David
CP5 S2 L2

The atomic structure of matter; x-rays; optics and optical instruments; wave theory. Properties of elements and compounds; introductory organic chemistry.

TEXT1201
Introductory Textile Technology
Staff Contact: Prof Ross Griffith
CP10 S2 L3 T1

Sampling theory and practice for textile testing. Introductory statistics for data processing. Basic techniques for the measurement of fibre properties, including transverse dimensions and length. The application of engineering principles to textile machines and processes, including mechanics of solids, statics, mechanical transmission of power.

TEXT2101
Fibre Science 2
Staff Contact: Prof Ron Postle
CP10 S2 L2 T2
Prerequisite: FIBRE1101/TEXT1101

Fibre microscopy. Electron microscopy. Fibre reflection and lustre. Morphological and fine structure of fibres. X-ray Crystallography. Polymer crystallisation. Molecular structure of proteins. Optical properties and fibre orientation. Infra-red spectroscopy. Fibre rheology. Mechanical properties. Addition and condensation polymerization. Chemical constitution and reactivity of man-made fibres. Introduction to high technology fibres. Laboratory experiments on fibre and electron microscopy, x-ray diffraction and infra-red spectroscopy, fibre structure and viscoelasticity.

TEXT2201
Textile Statistics
Staff Contact: Dr Xungai Wang
CP5 S2 L2

Application of mathematical techniques to textile data processing and analysis. Probability theory, distribution functions, tests of significance. Analysis of variance, regression analysis. Introduction to computer statistical packages.

TEXT2301
Yarn Technology 1
Staff Contact: Dr Xungai Wang
CP15 S1 L3 T3
Prerequisite: TEXT1201

The preparation of staple fibres for yarns and non-woven fabrics: processes for tow conversion, opening, cleaning, blending, carding, drawing, and combing. Short-staple, worsted and woollen preparation systems. Computer blend selection; drafting theory; theory and measurement of irregularity; levelling of slivers.

TEXT2401
Fabric Technology 1
Staff Contact: Dr John Curiskis
CP15 S2 L3.5 T2.5
Prerequisite: TEXT1201

Principles of weaving. Mechanisms of shedding, picking, and beating up. Secondary and auxiliary mechanisms of looms. Cam, dobby and jacquard shedding. Shuttle, projectile, rapier and jet weft insertion. Multiphase weaving; circular weaving. Woven cloth construction principles and weave representation; basic weave structures. Leno and narrow fabric weaving. Woven pile fabric constructions; tufting. Yarn preparation for weaving. Mechanics of woven fabric formation. Introduction to knitting technology.

TEXT3101
Textile Structures 1
Staff Contact: Prof Ron Postle
CP7.5 S1 L1 T2
Prerequisite: FIBR1101/TEXT1101

Fibrous structures and textile assemblies. Fibre friction and visco-elasticity. Lubrication. Static electrification of textiles. Yarn structures. Fibre migration in yarns. Mechanics of continuous filament yarns, staple-fibre yarns, plied and textured yarns. Fabric testing; structure and dimensions; tensile strength; tear strength; fabric abrasion. Fabric low-stress mechanical and surface properties. Drape and handle. Fabric tailorability. Laboratory experiments on yarn and fabric structure, mechanical and physical properties.

TEXT3301
Yarn Technology 2
Staff Contact: Dr Xungai Wang
CP15 S2 L3 T3
Prerequisite: TEXT1201

Properties of yarns. Introduction to geometry and mechanics of twisted structures. Staple yarn forming by ring, rotor and unconventional spinning methods. Twisting and winding processes. Throwing and texturing of continuous filament yarns. On-line monitoring of production and quality; automation. Measurement of yarn properties.

TEXT3401
Fabric Technology 2
Staff Contact: Dr John Curiskis
CP15 S1 L3.5 T2.5
Prerequisite: TEXT1201

Principles of knitting. Techniques of loop formation in weft and warp knitting; essential machine mechanisms. Knitted cloth construction principles and knitted structure representations; basic knitted structures. Techniques of jacquard needle selection and loop transfer for extended design effects in weft knitting; derivative weft knitted structures. Shaped weft knitted structures, including fully-fashioned knitting, hosiery manufacture, integral knitting techniques. Use of multiple guide bars, part-set threading, and auxillary mechanisms for extended design effects in tricot and raschel warp knitting; derivative warp knitted structures. Double needle bed warp knitting. Mechanics of knitted fabric formation. Stitch-bonded and non-woven fabric manufacture.

TEXT3501
Finishing Technology A
Staff Contact: Dr Shantha David
CP10 S1 L2 T2
Prerequisite: FIBR1101/TEXT1101

Objects of finishing and typical flow diagrams for wool and cotton. The principles and technology of textile finishing processes for protein and cellulosic fabrics, including the removal of impurities and discolouration, the elimination or minimisation of deficiencies in properties, the development of specific properties. Properties of surfactant solutions, micelle formation, surfactants as emulsifiers and detergents. Practical exercises in fabric bleaching, wool milling and shrinkproofing. Analysis of hard water by tritation.

TEXT3601
Colour Science
Staff Contact: Prof Mike Pailthorpe
CP7.5 S1 L2 T1

Aspects of colour, colour mixing and colour vision. Absorptiometry, spectrophotometry and tristimulus colorimetry. Measurement and specification of colour and colour difference. Applications of colour measurement. Computer aided colour match prediction.

TEXT3602
Colouration Technology
Staff Contact: Prof Mike Pailthorpe
CP10 S2 L2 T2
Prerequisite: FIBR1101/TEXT1101

Classification of dyes and pigments and their methods of application. General properties of dyes, dyeing auxiliaries and after treatments. Assessment of colourfastness properties of dyes and pigments. Mill water supplies and their treatment. Aspects of dyehouse effluent treatment. Textile dyeing machinery. Recent developments in dyeing and printing technology.

TEXT3801
Textile Engineering
Staff Contact: Prof Ross Griffith
CP7.5 S2 L2 T1
Prerequisite: TEXT1201

Applied Electricity. Illumination design. Introduction to process control. Thermodynamic principles and applications in textile processing including first and second laws, states and processes, fluid properties. Properties and use of steam. Air conditioning. Heat transfer. Introduction to fluid mechanics. Energy utilisation in textile processes.

TEXT4003
Project
Staff Contact: Prof Ron Postle
CP35 F S1 T5 S2 T9

Students are required to carry out a research project and to submit a thesis describing their investigations. It is usual for students to be allocated projects in areas related to the particular course option they are studying.

TEXT4013
Seminar
Staff Contact: Prof Mike Pailthorpe
CP10 F T2

Students prepare and present a seminar before an audience consisting of staff of the Department, final year

students, Graduate Diploma students, and any other interested undergraduate or postgraduate students, on a subject of topical and specific interest in the field of textile science, technology or management, and subsequently submit the seminar in writing.

TEXT4101
Textile Structures 2
Staff Contact: Prof Ron Postle
CP7.5 S2 L1 T2
Prerequisite: FIBR1101/TEXT1101

Physical equilibration of textile materials, ageing and annealing. Structural mechanics of woven, knitted and non-woven fabrics. Composite materials, fabric membrane properties. Clothing mechanics and tailorability. Fabric rheology. Wrinkling properties. Clothing comfort and physiology. Thermal insulation. Diffusion of moisture. Heat and mass transfer. Capillary action of textiles. Laboratory experiments on textile equilibration, tailorability of textile materials, heat and moisture transfer in textiles.

TEXT4201
Processing Laboratory
Staff Contact: Dr John Curiskis
CP7.5 S1 T3

Students undertake a project involving the design, production and assessment of textile products. Such as: rib jacquard outer fabric, towelling, printed tea towels, woven furnishing fabric, raschel outer wear fabric, etc.

TEXT4202
Textile Quality Control
Staff Contact: Prof Mike Pailthorpe
CP5 S2 L1 T1
Prerequisite: TEXT2201

User-serviceability testing. Fibre content and care-labelling. Process and quality control. Consumer problems.

TEXT4501
Finishing Technology B
Staff Contact: Dr Shantha David
CP10 S2 L2 T2
Prerequisite: FIBR1101/TEXT1101

Wet and dry fabric finishing. The application of special finishes including flame retardant finishes, crease resistant and antistatic finishes, etc. Fabric setting Dimensional stability and its measurement. The drying of textile materials. Recent developments in finishing technology.

TEXT4701
Textile Industry Studies
Staff Contact: Prof Ross Griffith
CP7.5 S1 L T3

Econometrics of the textile and clothing industries. Models of production, import and export and consumption of textiles and clothing in Australia, and comparison with world data. Case studies in textile and clothing manufacture operations. Environmental considerations in relation to pollution from the textile industry. Waste water treatment methods.

TEXT4702
Textile Management*
Staff Contact: Dr John Curiskis
CP15 S1 T6

**Co-Op Students only*

Selected readings in the Management of manufacturing systems with particular reference and examples from specific manufacturing enterprises.

TEXT5001
Textile Technology Dissertation
Staff Contact: Prof Mike Pailthorpe
CP7.5 F T1.5

Students review a particular aspect of textile technology, by conducting a literature survey and conferring with experts. The review is presented orally to the staff and students of the department, and submitted in written form.

TEXT5003
Textile Technology
Staff Contact: Prof Ross Griffith
CP7.5 F T1.5

Students gain an overview of textile technology by reviewing the technology relating to one or more textile products, through a series of tutorials and exercises.

TEXT5101
Fibre Science A
Staff Contact: Dr Shantha David
CP15 S1 L4 T2

Fibre classification and raw materials. Polymer requirements for fibre formation. Introduction to fibre structure and morphology. Physical and chemical properties of textile fibres. Production of natural and man-made fibres. Necessary and desirable attributes of textile fibres. Fibre mechanical properties, structure and physical properties of wool keratin. Laboratory classes on fibre identification and fibre microscopy.

TEXT5102
Fibre Science B
Staff Contact: Prof Ron Postle
CP10 S2 L2 T2

Fibre microscopy. Electron microscopy. Fibre reflection and lustre. X-ray Morphological and fine structure of fibres. Crystallography. Polymer crystallisation. Molecular structure of proteins. Optical properties and fibre orientation. Infra-red spectroscopy. Fibre rheology. Mechanical properties. Moisture sorption and swelling. Addition and condensation polymerization. Chemical constitution and reactivity of man-made fibres. Introduction to high technology fibres. Laboratory experiments on fibre and electron microscopy, x-ray diffraction and infra-red spectroscopy, fibre structure and viscoelasticity.

TEXT5201
Textile Quality Control
Staff Contact: Prof Mike Pailthorpe
CP5 S2 L1 T1

User-serviceability testing. Fibre content and care-labelling. Process and quality control. Consumer problems.

TEXT5301
Yarn Technology A
Staff Contact: Dr Xungai Wang
CP12.5 S1 L3 T3

The preparation of staple fibres for yarns and non-woven fabrics: processes for tow conversion, opening, cleaning, blending, carding, drawing, and combing. Short-staple, worsted and woollen preparation systems. Computer blend selection; drafting theory; theory and measurement of irregularity; levelling of slivers.

TEXT5302
Yarn Technology B
Staff Contact: Dr Xungai Wang
CP12.5 S2 L3 T2

Properties of yarns. Introduction to geometry and mechanics of twisted structures. Staple yarn forming by ring, rotor and unconventional spinning methods. Twisting and winding processes. Throwing and texturing of continuous filament yarns. On-line monitoring of production and quality; automation. Measurement of yarn properties.

TEXT5401
Fabric Technology A
Staff Contact: Dr John Curiskis
CP12.5 S2 L3.5 T1.5

Principles of weaving. Mechanisms of shedding, picking, and beating up. Secondary and auxiliary mechanisms of looms. Cam, dobby and jacquard shedding. Shuttle, projectile, rapier and jet weft insertion. Multiphase weaving, circular weaving. Woven cloth construction principles and weave representation; basic weave structures. Leno and narrow fabric weaving. Woven pile fabric constructions; tufting. Yarn preparation for weaving. Mechanics of woven fabric formation.

TEXT5402
Fabric Technology B
Staff Contact: Dr John Curiskis
CP12.5 S1 L3.5 T1.5

Principles of knitting. Techniques of loop formation in weft and warp knitting; essential machine mechanisms. Knitted cloth construction principles and knitted structure representations; basic knitted structures. Techniques of jacquard needle selection and loop transfer for extended design effects in weft knitting; derivative weft knitted structures. Shaped weft knitted structures, including fully-fashioned knitting, hosiery manufacture, integral knitting techniques. Use of multiple guide bars, part-set threading, and auxiliary mechanisms for extended design effects in tricot and raschel warp knitting; derivative warp knitted structures. Double needle bed warp knitted. Mechanisms of knitted fabric formation. Stitch-bonded and non-woven fabric manufacture.

TEXT5501
Finishing Technology A
Staff Contact: Dr Shantha David
CP12.5 S1 L3 T2

Objects of finishing and typical flow diagrams for wool and cotton. The principles and technology of textile finishing processes for protein and cellulosic fabrics, including the removal of impurities and discolouration, the elimination or minimisation of deficiencies in properties, the development of specific properties. Properties of surfactant solutions, micelle formation, surfactants as emulsifiers and detergents. Practical exercises in bleaching, wool milling and shrinkproofing. Analysis of hard water by tritation.

TEXT5502
Finishing Technology B
Staff Contact: Dr Shantha David
CP12.5 S2 L2 T3

Wet and dry fabric finishing. The application of special finishes including flame retardant finishes, crease resistant and antistatic finishes, etc. Fabric setting. Dimensional stability and its measurement. The drying of textile materials. Recent developments in finishing technology.

TEXT5601
Colour Science
Staff Contact: Prof Mike Pailthorpe
CP10 S1 L2 T1

Aspects of colour, colour mixing and colour vision. Absorptiometry, spectrophotometry and tristimulus colorimetry. Measurement and specification of colour and colour difference. Applications of colour measurement. Computer aided colour match prediction.

TEXT5602
Dyeing Technology
Staff Contact: Prof Mike Pailthorpe
CP10 S2 L2 T2

Classification of dyes and pigments and their methods of application. General properties of dyes, dyeing auxiliaries and after-treatments. Assessment of colour-fastness properties of dyes and pigments. Mill water supplies and their treatment. Aspects of dye-house effluent treatment. Textile printing methods. Textile dyeing machinery. Recent developments in dyeing and printing technology.

WOOL2103
Livestock Production 1
Staff Contact: A/Prof John Kennedy
CP10 F L2

The sheep and beef cattle industries and their place in the economic life of Australia; levels of production and trends. The physical, biological, managerial and economic conditions influencing production. Sheep producing zones. Sheep breeds for wool production. Cross breeding, prime lamb production. Sheep and cattle management; nutrition, reproduction, survival. A field excursion of one week's duration is held in Session 1.

WOOL2203
Agronomy
Staff Contact: Dr Gordon King
CP22.5 S1 L2 T1 S2 L3 T3

Agricultural climatology, soil science, and soil conservation. Pastures in land use and land development. Principles of tillage, crop rotation, irrigation, conservation of fodder and fertiliser usage. Weeds and weed control. Practical work in the systematics of selected plant families.

WOOL2303
Agricultural Economics and Management 1
Staff Contact: Mr Steve Filan
CP15 F L2 T1

Farm planning methods. Budgeting, gross margins, simplified programming and introduction to linear programming. Use of VAX computers: introduction to operating system, text editor, and linear programming

software. Introduction to farm management implications of land tenure and title; valuation; depreciation; discounting; taxation. Economic principles. Introduction to production economics theory, cost curves, and price theory.

WOOL2503
Wool Science 1
Staff Contact: A/Prof David Cottle
CP15 F L2 T1

(Preparation and Early Stage Processing) Fleece characteristics and their variation; wool faults; clip preparation - past, present and future; evaluation and typing of wool; value and use of wool; felting; fellmongering; marketing. Early stage processing and yarn manufacture.

WOOL2601
Animal Physiology 1
Staff Contact: A/Prof John Kennedy
CP15 S2 L3 T3
Prerequisite: BIOS1201

Physiology systems of mammalia are treated with special attention to homeostasis. Cell-membranes; blood and body fluids; the immune reaction. Cardiac control, functions and haemodynamics. Respiration. The endocrine system with particular emphasis upon growth, reproduction, lactation and stress. The nerve impulse, its excitation and transmission. Physiology of digestion, the gastro-intestinal tract and of the kidney. Heat tolerance and climatic adaptation.

WOOL3111
Livestock Production 2
Staff Contact: Dr Doug Murray
CP7.5 S2 L2 T1
Prerequisite: WOOL2103

Feed lot production of cattle as an intensive system and the factors affecting output such as environmental conditions, nutrition and disease. Establishment and management of a feed lot. Use of metabolisable and net energy requirements to calculate dry matter intakes of feeds of varying nutritive value for different productive states.

WOOL3203
Pastoral Agronomy
Staff Contact: Dr Gordon King
CP20 F L3 T1
Prerequisite: WOOL2203

Pasture ecology. Establishment, management and utilisation of pastures and fodder crops. Pasture-animal relationships, stocking rates, mixed stocking. Vegetation management in arid and semi-arid areas. Pasture evaluation and pasture research techniques.

WOOL3211
Crop Agronomy
Staff Contact: Dr Gordon King
CP7.5 S2 L2 T1
Prerequisite: WOOL2203
Note/s: Available in alternate years. Not available in 1995.

Field crop production associated with the pastoral industries. Crop physiology. Cropping practices. Pests and diseases.

WOOL3221
Range Management
Staff Contact: Dr Gordon King
CP7.5 S2 L1 T2
Co or Prerequisite: WOOL3203

Basic range ecology and rangeland ecosystems. Plant physiology, growth and development of rangeland plants. Rangeland management practices. Monitoring of long-term trends in productivity. Applications of remote sensing and ground truth sampling. Wild life resources and feral animals and their management. Sheep and beef cattle production in arid and semi-arid environments. Administration of rangelands (e.g. the functions of the Western Lands Commission, the National Parks and Wildlife Service, and the Soil Conservation Service in New South Wales). Involves one week of instruction at Fowlers Gap Research Station.

WOOL3401
Animal Nutrition
Staff Contact: Dr Geoff Robards
CP10 S2 L3 T1

Composition and classification of foodstuffs and pastures. Digestion absorption and metabolism of carbohydrates, proteins, fats, mineral and vitamins. Digestibility of feedstuffs. Nutrient and energy balances and requirements of livestock. Feeding standards and the quantitative application of nutritional data with particular reference to Australian conditions. Supplementary and drought feeding. Consideration of disorders due to nutrition. While particular emphasis is given to nutritional requirements of sheep, those of other farm livestock are dealt with in this section.

WOOL3503
Wool Science 2
Staff Contact: A/Prof David Cottle
CP15 F L2 T1

(Metrology and late stage processing) Sampling wool for measurement; measurement of fibre diameter, length, colour, yield, vegetable matter, regain, resistance to compression, bulk, medullation, dark fibres and style; test certificates; statistics; standards; use of measurements in marketing and manufacture; fabric manufacture, dyeing and finishing.

WOOL3511
Wool Marketing
Staff Contact: A/Prof John Kennedy
CP7.5 S2 L2 T1

Wool marketing systems; comparison with other countries, modelling. Wool commerce; financial factors. Information systems. Future directions.

WOOL3521
Wool Biology
Staff Contact: Dr Peter Auer
CP15 S2 L3 T3
Prerequisite: FIBR1001, BIOS1201

The study of the biology of the skin and the fleece which relates the characteristics of the wool follicle and fibre to the production, technology and processing of wool. Follicle morphology and function; the components of wool; develoment of wool follicles; follicle physiology; regulation of follicle funtion and fibre production; manipulation of follicle function; individual vs populations of follicles and

fibres; physical characteristics of the fleece; wool and other textile fibres.

WOOL3701
Animal Health and Welfare 1
Staff Contact: A/Prof John Kennedy
CP7.5 S1 L2 T1
Prerequisite: WOOL2103

Managerial control of grazing livestock health and welfare. The concept of economic approach to animal health. Introductory immunology. Skin health in sheep and cattle. Control of external parasites, particularly by insecticides. Reproductive health in sheep and cattle. Internal parasites. Legal and Public Health responsibilities; Acts of Parliament relating to animal health and welfare.

WOOL3803
Genetics 1
Staff Contact: A/Prof John James
CP15 F L2 T1

Mendelian inheritance. Chromosomes, linkage and the physical basis of heredity. Gene action in physiology and development. Elements of molecular genetics. Principles of quantitative genetics, strength of inheritance and relationships. Selection and crossbreeding. Genetics applied to animal and plant improvement. Applications of genetics in sheep and wool production.

WOOL3901
Biostatistics 1
Staff Contact: A/Prof John James
CP10 S1 L2 T2

Design and analysis of comparative experiments, for continuous and discrete random variables. Analysis of variance for fixed, mixed and random models. Linear regression and correlation. Multiple comparison methods.

WOOL4003
Project
Staff Contact: A/Prof John Kennedy
CP30 F T6

Students are required to conduct an experimental or theoretical investigation under supervision and to submit a thesis describing the results of their investigations. Throughout the year students are required to submit progress reports to their supervisors and to present seminars. The written reports of the project shall be submitted by the last day of Session 2.

WOOL4013
Seminar
Staff Contact: A/Prof John Kennedy
CP10 F T2

Seminars deal with research and or development work being undertaken or recently completed by students and staff of the Department of Wool and Animal Science, other University schools and research organisations. There are also seminars on communication in wool and pastoral sciences and on problems facing rural industries.

WOOL4113
Livestock Production 3
Staff Contact: A/Prof John Kennedy
CP15 CP15 F L1 T2

Principles of livestock production applied to reproduction and fertility; growth and development. The meat industry. Carcass conformation and composition. Pre and post mortem factors affecting meat quality. Meat marketing.

WOOL4413
Ruminant Nutrition
Staff Contact: Dr Geoff Robards
CP10 S1 L2 T2
Prerequisite: WOOL3401

Utilisation of metabolisable energy: protein digestion and utilisation; digestion of complex carbohydrates; digestive upsets: bloat, acidosis, rumen stasis; techniques for measuring nutrient dynamics and body turnover rates; formulation of specialised rations for: feedlots, live sheep trade, Sharlea wool production, milk production.

WOOL4513
Wool Science 3
Staff Contact: A/Prof David Cottle
CP20 F L2 T2

(Advanced Technology) Sale by description; modelling wool production; developmental metrology techniques; the Australian wool processing industry; breeding for wool quality; woollen metrology; keratin fine structure; caprine and cameloid fibres; processed wool metrology; wool classification; lot building; current wool research and development.

WOOL4813
Genetics 2
Staff Contact: A/Prof John James
CP20 F L2 T2
Prerequisite: WOOL3803

Genetic structure of populations. Forces causing genetic change. Partition of genetic and phenotypic variation. Resemblance between relatives and estimation of genetic parameters. Direct and correlated selection responses. Aids to selection and selection indexes. Inbreeding and genetic drift. Genotype environment interaction. Heterosis and its utilisation. Interaction of natural and artificial selection. Limits of selective progress. Applications of molecular genetics.

WOOL4911
Biostatistics 2
Staff Contact: A/Prof John James
CP10 S2 L2 T2

Least squares methods, applied to multiple regression and experimental design models. Factorial experiments. Analysis of co-variance. Elements of multi-variate analysis.

WOOL5113
Livestock Production
Staff Contact: A/Prof J P Kennedy
CP48 F L2 T4

Biology of reproduction and reproductive performance of sheep and cattle; growth and body composition; meat production and quality.

WOOL5213
Range Management
Staff Contact: Dr Gordon King
CP12 F L1 T3

Objectives in the utilisation and management of rangelands. Ecology of rangelands, with emphasis on the impact of grazing. Degradation of rangelands. Morphology and physiology of range plants in relation to management.

Grazing management. Burning as a management practice. Assessment of range condition and trend. Applications of remote sensing. Sheep and cattle production in arid and semiarid environments. Native and feral animals and their management. Diet selection of different species. Administration of rangelands. Assignment work and field studies, including a week at Fowlers Gap Arid Zone Research Station.

WOOL5223
Project in Range Management
Staff Contact: Dr Gordon King
CP36 F T9

A theoretical and or experimental investigation of some aspect of management of rangelands.

WOOL5513
Wool Science
Staff Contact: A/Prof David Cottle
CP48 F L2 T4

Biology and histology of fibre growth and fibre structure. Wool physics and chemistry. Objective characteristics of the Australian wool clip. Preparation for sale, measurement, specification, valuation and marketing of wool. Wool metrology and conditioning house procedures. Fibre parameters in processing.

WOOL5813
Animal Breeding
Staff Contact: A/Prof John James
CP32 F L2 T2
Corequisite: WOOL3803

Definition of breeding objectives; case studies of production recording and breed improvement programs for sheep and beef cattle. Development of performance recording systems: choice of traits to be recorded, recording and processing methods. Estimation of breeding value from performance records. Breed evaluation. Optimal design for breeding programs. The impact on genetic improvement of techniques for controlling reproduction and molecular genetics.

WOOL5913
Quantitative Methods
Staff Contact: A/Prof John James
CP32 F L2 T2

Selected topics in: biostatistics, with emphasis on experimental design and on least squares procedures; mathematical programming methods for rural industries; data processing and computer programming; systems analysis and simulation methods.

School of Geography

Head of School
Associate Professor MD Fox

Administrative Officer
Ms C Bilic

Geographers study the spatial relationships of the phenomena which form humans' physical and social environment, and aim to establish principles which govern those relationships. The geographer may concentrate on specific variables, as in systematic geography, or may deal with variables which affect a specific area, as in regional geography.

The cultural significance of geography lies in its contribution to an understanding of the total environment, but the geographer's skills also find practical application in the conservation and planned development of resources. Increasing numbers of geographers are employed as professionals in these applications. For instance, geomorphologists and biogeographers are undertaking resource inventory surveys and environmental assessment, and economic geographers are engaged as urban and regional planners and spatial analysts.

Students are advised to check notices displayed in the School of Geography ground floor foyer in case of any late changes in teaching arrangements.

Undergraduate Study

Course Outlines

The three vocationally-oriented Applied Geography programs **3010** in the Faculty of Applied Science provide an analytical approach to understanding and investigating some of society's most pressing problems, including the use and management of scarce resources, the interaction between people and environment, soil erosion and conservation, land use conflicts, and spatial inequalities in economic and social well-being. These courses provide elective specialisations in physical geography (with special emphasis on either the biologic or geomorphic aspects), economic geography with emphasis on spatial analysis, and in human and physical resources (with emphasis on the integration of human and physical geography).

Geography is also available as a major sequence in the Arts course **3400**, where the emphasis is on the study of where and how people live, and on their activities in relation to the environment.

Major sequences in Science and Mathematics course **3970**, programs **2700** and **6581** study the relationships between people and the physical environment, combining geographical studies, particularly in physical geography, with those in related disciplines, notably the biological and earth sciences.

Geography may also be combined with Civil Engineering in course **3730**, and with Law in course **4770**.

Students may enrol through the School of Geography for higher research degrees, or for formal graduate courses such as the Master of Applied Science in Geographic Information Systems **8027.1000**; Masters and Diploma courses in Remote Sensing **8047.2000** and **5047.2000**, Master in Environmental Management **8047.3000** and may undertake projects in the School as part of the Master of Environmental Studies degree **8045.**

Applied Geography - Full-time Courses

Bachelor of Science
BSc

The School offers three four-year full-time courses leading to the award of the degree of Bachelor of Science, which aim to train professional geographers for entry into applied fields.

There are elective specialisations in physical geography (with special emphasis on either the biologic or geomorphic aspects), economic geography (with emphasis on urban and regional analysis), and in human and physical resources (with emphasis on the integration of physical and human geography). First year subjects involve systematic studies of the physical and economic bases of geography. There is progressive specialisation in the following years, with heavy emphasis on field observation and data handling. For the award of the degree at Honours level students will be required to have distinguished themselves in coursework, in additional assignments as directed by the Head of the School, and in the final year project for which a Report will be required.

All students are encouraged to spend a period of four to six weeks with organisations concerned with the investigation and planned use of resources.

Several units in Geography include laboratory and project work involving the use of computer and quantitative techniques. It is required that students provide their own drawing materials such as tracing and graph paper. Details of exact requirements are given at the beginning of the relevant subjects. Compulsory fieldwork incurs personal expenditure and for some subjects notes and materials are available for a small charge.

3010.1000
Applied Physical Geography
Full-time Course

		HPW S1	HPW S2	CP
Year 1				
GEOG1000	Field Project 1	2	2	10
GEOG1043	Data Processing Systems	4	0	10
GEOG1044	Data Display Systems	0	4	10
GEOG1062	Australia and Global Development	4	0	15
GEOG1073	Environmental Processes and Analysis	0	6	15
and				
MATH1011	General Mathematics 1B *and*	6	0	15
MATH1021	General Mathematics 1C	0	6	15
or				
MATH1131	Mathematics 1A *and*	6	0	15
MATH1231	Mathematics 1B	0	6	15
or				
MATH1141	Higher Mathematics 1A *and*	6	0	15
MATH1241	Higher Mathematics 1B	0	6	15
and either				
BIOS1011	Evolutionary and Functional Biology *and*	6	0	15
BIOS1021	Molecules, Cells and Genes *or*	0	6	15
GEOL1101	Geological Processes *and*	6	0	15
GEOL1201	Geological Environments	0	6	15

Total HPW Session 1 22
Total HPW Session 2 24
Total Credit Points 120

Year 2				
GEOG2000	Field Project 2	1.5	1.5	10
GEOG2013	Geographic Data Analysis	4	0	15
GEOG2021	Introduction to Remote Sensing	0	4	15
GEOG2025	Biogeography	0	4	15
GEOG2051	Soils and Landforms	4	0	15
GEOG3122	Geographic Information Systems	0	4	15
GEOG3211	Australian Environments and Natural Resources	4	0	15
and either				
GEOL2011	Mineralogy and Igneous Petrology	6	0	15
GEOL2022	Petrology and Structural Geology	0	6	15
or any two of the following				
BIOS2011	Evolutionary and Physiological Ecology	6	0	15
BIOS2051	Flowering Plants	6	0	15
BIOS2061	Vertebrate Zoology	0	6	15
and for all students				
General Education subject/s		2	2	15

Total HPW Session 1 21.5
Total HPW Session 2 21.5
Total Credit Points 145

Year 3				
GEOG3000	Field Project 3	1.5	1.5	15
GEOG3011	Pedology	4	0	15
GEOG3025	Geomorphology	0	4	15
GEOG3032	Remote Sensing Applications	4	0	15
GEOG3062	Environmental Change	4	0	15
GEOG3082	Project Design & Formulation	0	3	10
GEOG3142	Geographic Information Systems Applications	0	4	15
and one of the following				
CHEM1101	Chemistry A	6	0	15
CHEM1401	Introductory Chemistry A	6	0	15
BIOS3051	Insect Diversity and Management	6	0	15
BIOS3061	Plant Ecosystem Processes	6	0	15
BIOS3071	Conservation Biology and Biodiversity	6	0	15
BIOS3111	Population and Community Ecology	0	6	15
GEOL7321	Geology for Geomorphologists and Pedologists	2	4	15
and for all students				
General Education subject/s		2	2	15

Total HPW Session 1 17.5/19.5
Total HPW Session 2 16.5/18.5
Total Credit Points 130

3010.2000
Applied Economic Geography
Full-time Course

		HPW S1	HPW S2	CP
Year 1				
GEOG1000	Field Project 1	2	2	10
GEOG1022	Locational Processes	0	4	10
GEOG1031	Environmental Processes	0	6	15
GEOG1043	Data Processing Systems	4	0	10
GEOG1044	Data Display Systems	0	4	10
GEOG1062	Australia and Global Development	3	0	15
and				
MATH1011	General Mathematics 1B *and*	6	0	15
MATH1021	General Mathematics 1C	0	6	15
or				
MATH1131	Mathematics 1A *and*	6	0	15
MATH1231	Mathematics 1B	0	6	15
or				
MATH1141	Higher Mathematics 1A *and*	6	0	15
MATH1241	Higher Mathematics 1B	0	6	15
and either				
ECON1101	Microeconomics 1 *and*	3	0	15
ECON1102	Macroeconomics 1	0	3	15
or				
ECON1103	Microeconomic Principles *and*	3	0	15
ECON1104	Macroeconomic Principles	0	3	15

Total HPW Session 1 19
Total HPW Session 2 23
Total Credit Points 130

Year 2				
GEOG2000	Field Project 2	1.5	1.5	10
GEOG2013	Geographical Data Analysis	4	0	15
GEOG2052	Project in Spatial Analysis	0	4	10
GEOG2061	Regional Theory	4	0	15
GEOG2071	Transport and Land Use	0	4	15
GEOG2092	Australian Social and Economic Landscapes	4	0	15
GEOG3122	Geographic Information Systems	0	4	15
ECON2103	Business and Government	0	3	15
ECON2104	Australian Macroeconomic Policy	3	0	15
and				
General Education subject/s		2	2	15

Total HPW Session 1 18.5
Total HPW Session 2 18.5
Total Credit Points 140

Year 3				
GEOG3000	Field Project 3	1.5	1.5	15
GEOG3041	Mathematical Methods for Spatial Analysis*	4	0	15
GEOG3082	Project Design and Formulation	0	3	10
GEOG3101	Sample Surveys and Questionnaire Design	4	0	10
GEOG3172	Spatial Population Analysis	0	4	15

		HPW S1	HPW S2	CP
plus three of the following				
GEOG2021	Introduction to Remote Sensing	0	4	15
GEOG3142	Geographic Information SystemsApplications	0	4	15
GEOG3181	Urban Activity Systems	4	0	15
GEOG3192	Urban and Regional Development	0	4	15
GEOG3333	Special Topic	2	2	15
GEOG3334	Special Research Methods	1	1	15
plus two of the following (one each session):				
ECON2108	Industry Economics and Australian Industrial Policy	0	3	15
ECON2109	Economics of Natural Resources	3	0	15
ECON2117	Economics of Tourism	3	0	15
ECON2127	Environmental Resources and Cost Benefit Analysis	0	3	15
ECON3115	Economics of Developing Countries	3	0	15
and for all students				
General Education subject/s		2	2	15

Total HPW Session 1 20.5
Total HPW Session 2 19.5
Total Credit Points 155

**One subject may be substituted for those listed with permission of Head of School.*

The following subjects may be substituted:

ECON2111	The Economics of Global Interdependence	0	3	15
ECON2115	Japanese International Economic Relations	0	3	15
ECON2116	Japanese Economic Policy	3	0	15

3010.3000
Human and Physical Resources - Physical
Full-time Course

Year 1 (same as for 3010.1000)				
GEOG1000	Field Project 1	2	2	10
GEOG1043	Data Processing Systems	4	0	10
GEOG1044	Data Display Systems	0	4	10
GEOG1062	Australia and Global Development	4	0	15
GEOG1073	Environmental Processes and Analysis	0	6	15
and				
MATH1011	General Mathematics 1B	6	0	15
and				
MATH1021	General Mathematics 1C	0	6	15
or				
MATH1131	Mathematics 1A *and*	6	0	15
MATH1231	Mathematics 1B	0	6	15
or				
MATH1141	Higher Mathematics 1A *and*	6	0	15
MATH1241	Higher Mathematics 1B	0	6	15
and either				
BIOS1011	Evolutionary and Functional Biology *and*	6	0	15
BIOS1021	Molecules, Cells and Genes *or*	0	6	15

		HPW S1	HPW S2	CP
Year 1 (cont)				
GEOL1101	Geological Processes *and*	6	0	15
GEOL1201	Geological Environments	0	6	15
Total HPW Session 1	**22**			
Total HPW Session 2	**24**			
Total Credit Points	**120**			
Year 2				
GEOG2000	Field Project 2	1.5	1.5	10
GEOG2013	Geographical Data Analysis	4	0	15
GEOG2025	Biogeography	0	4	15
GEOG2051	Soils and Landforms *or*	4	0	15
GEOG2092	Australian Social and Economic Landscapes	4	0	15
GEOG3122	Geographic Information Systems	0	4	15
and either				
GEOL2011	Mineralogy and Igneous Petrology and	6	0	15
GEOL2022	Petrology and Structural Geology	0	6	15
or two of the following				
BIOS2011	Evolutionary and Physiological Ecology	6	0	15
BIOS2031	Biology of Invertebrates	0	6	15
BIOS2051	Flowering Plants	0	6	15
BIOS2061	Vertebrate Zoology	6	0	15
and for all students				
General Education subject/s		2	2	15
Total HPW Session 1	**27.5/15.5**			
Total HPW Session 2	**11.5/23.5**			
Total Credit Points	**130**			
Year 3				
GEOG2021	Introduction to Remote Sensing	0	4	15
GEOG3000	Field Project 3	1.5	1.5	15
GEOG3062	Environmental Change	4	0	15
GEOG3082	Project Design and Formulation	0	3	10
GEOG3172	Spatial Population Analysis	0	4	15
plus two of the following				
GEOG3011	Pedology	4	0	15
GEOG3025	Geomorphology	0	4	15
GEOG3032	Remote Sensing Applications	4	0	15
GEOG3142	Geographic Information Systems Applications	0	4	15
and one of the following				
BIOS3061	Plant Ecosystem Processes	6	0	15
BIOS3071	Conservation Biology and Diversity	6	0	15
GEOL7321	Geology for Geomorphologists and Pedologists	2	4	15
and for all students				
General Education subject/s		2	2	15
Total HPW Session 1	**21.5/9.5**			
Total HPW Session 2	**14.5/26.5**			
Total Credit Points	**130**			

Human and Physical Resources - Economic 3010.4000

		HPW S1	HPW S2	CP
Year 1 (same as for 3010.2000)				
GEOG1000	Field Project 1	2	2	10
GEOG1022	Locational Processes	0	4	10
GEOG1031	Environmental Processes	0	6	15
GEOG1043	Data Processing Systems	4	0	10
GEOG1044	Data Display Systems	0	4	10
GEOG1062	Australia and Global Development	3	0	15
and				
MATH1011	General Mathematics 1B *and*	6	0	15
MATH1021	General Mathematics 1C	0	6	15
or				
MATH1131	Mathematics 1A *and*	6	0	15
MATH1231	Mathematics 1B	0	6	15
or				
MATH1141	Higher Mathematics 1A *and*	6	0	15
MATH1241	Higher Mathematics 1B	0	6	15
and either				
ECON1101	Microeconomics 1 *and*	3	0	15
ECON1102	Macroeconomics 1	0	3	15
or				
ECON1103	Microeconomic Principles *and*	3	0	15
ECON1104	Macroeconomic Principles	0	3	15
Total HPW Session 1	**19**			
Total HPW Session 2	**23**			
Total Credit Points	**130**			
Year 2				
GEOG2000	Field Project 2	1.5	1.5	10
GEOG2013	Geographical Data Analysis	4	0	15
GEOG2025	Biogeography	0	4	15
GEOG2052	Project in Spatial Analysis	0	4	10
GEOG2061	Regional Theory	4	0	15
GEOG2092	Australian Social and Economic Landscapes	4	0	15
GEOG3122	Geographic Information Systems	0	4	15
ECON2103	Business and Government	0	3	15
ECON2104	Australian Macroeconomic Policy	3	0	15
and for all students				
General Education Subject/s		2	2	15
Total HPW Session 1	**18.5**			
Total HPW Session 2	**18.5**			
Total Credit Points	**140**			

		HPW S1	HPW S2	CP
Year 3				
GEOG2021	Introduction to Remote Sensing	0	4	15
GEOG3000	Field Project 3	15	1.5	15
GEOG3062	Environmental Change	4	0	15
GEOG3082	Project Design and Formulation	0	3	10
GEOG3172	Spatial Population Analysis	0	4	15
and two of the following				
GEOG3011	Pedology	4	0	15
GEOG3025	Geomorphology	0	4	15
GEOG3032	Remote Sensing Applications	4	0	15
GEOG3142	Geographic Information Systems Applications	0	4	15
and two of the following				
ECON2109	Economics of Natural Resources	3	0	15
ECON2117	Economics of Tourism	3	0	15
ECON2127	Environmental Resources and Cost Benefit Analysis	0	3	15
and for all students				
Genral Education Subject/s		2	2	15

Total HPW Session 1 21.5/10.5
Total HPW Session 2 14.5/25.5
Total Credit Points 145

Applied Physical Geography 3010.1000
Applied Economic Geography 30100.2000 and Human and Physical Resources - Physical 3010.3000
Human and Physical Resources - Economic 3010.4000

		HPW S1	HPW S2	CP
Year 4 All Strands				
GEOG3042	Environmental Impact Assessment	4	0	15
GEOG4010	Field Project 4	0	8	20
GEOG4031	Project	16	0	40
GEOG4042	Practical Applications	3	0	10
GEOG4052	Advanced Spatial Analysis*	0	4	15
GEOG4062	Advanced Environmental Analysis*	0	4	15

Total HPW Session 1 19
Total HPW Session 2 20
Total Credit Points 115

**Up to two subjects may be substituted from those offered by the School of Geography, Department of Applied Geology or School of Biological Sciences, subject to approval by the Head of School.*

Note: Students will incur personal costs in connection with project work in the final year of study.

Graduate Study

A number of coursework Masters degrees and Graduate Diplomas are available through the School of Geography. In addition the School welcomes enquiries from graduates who are interested in research leading to the award of the degrees of Doctor of Philosophy **1080** or Master of Science **2040.**

Course Outlines

8027.1000
Graduate Program in Geographic Information Systems

Master of Applied Science
MAppSc

The Masters degree program in Geographic Information Systems is offered in both Geography and Geology within the Faculty of Applied Science. Entry into either discipline depends on the background of the applicant and the orientation of the proposed program.

Entry qualifications. Four-year Honours degree of appropriate standard in Geography, Geology, Geomatic Engineering, or a relevant environmental science.

Course requirements. Candidates are required to complete a course totalling a minimum of 120 credits made up of compulsory subjects, elective subjects and a project. The degree will normally comprise one year of full-time study or two years of part-time study.

Compulsory Subjects		**CP**
GEOG9240	Principles of Geographic Information Systems	12
GEOG9241	Advanced Geographic Information Systems	12
GEOG9512	Project	48
and either		
GEOG9280	Applications and Management of GIS	12
or		
GMAT9604	Land Information Systems	12

Elective Subjects		CP
COMP9311	Introduction to Data Base Systems	15
GEOG9150	Remote Sensing Applications	12
GEOG9210	Computer Mapping and Data Display	12
GEOG9250	Special Topic	12
GEOG9290	Image Analysis in Remote Sensing	
GMAT9530	Analytical Photogrammetry	12
GMAT9532	Data Acquisition and Terrain Modelling	12
GMAT9600	Principles of Remote Sensing	12
KCME1110	Geographical Information Systems in Applied Geology	12

Note: Other subjects may be substituted for those listed with permission of the Course Coordinator to suit the specific needs of individual students.

*Students wishing to include both of these subjects should take one as an elective.

Graduate Programs in Rangeland Management

Programs are available leading to the award of:

Master of Applied Science in Rangeland Management **8025**
Graduate Diploma in Rangeland Management **5025**
See entry under Wool and Pastoral Science

The University has considerable experience of research and teaching relating to the management of arid zone rangelands, gained over many years by several of its schools. This experience is now used in the provision of these graduate programs based at the University campus in Kensington, Sydney, but also providing for the use of its field station resources including Fowlers Gap Arid Zone Research Station in western New South Wales.

Graduate Programs in Remote Sensing

Programs are available leading to the award of:

Master of Applied Science in Remote Sensing **8047.2000**
Graduate Diploma in Remote Sensing **5047.2000**

8047.2000
Remote Sensing

Master of Applied Science
MAppSc

The masters degree program in Remote Sensing is offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either Faculty depends on the background of the applicant and the orientation of the proposed program.

Entry qualifications. Four-year degree of appropriate standard in engineering, geography, geology, geomatic engineering, or in a relevant environmental, biological or agricultural science.

Course requirements. Candidates are required to complete a course totalling 120 credits, made up of compulsory subjects, electives, and a project. Compulsory subjects not offered in a particular year may be substituted by an equivalent subject, approved by the appropriate Course Coordinator. The degree will normally comprise one year of full-time study or two years of part-time study.

Compulsory Subjects		CP
GEOG9150	Remote Sensing Applications	12
GEOG9290	Image Analysis in Remote Sensing	12
GMAT9600	Principles of Remote Sensing	12
GMAT9606	Microwave Remote Sensing	12
and either		
GEOG9512	Project or	48
GEOL0114	Project	48

Elective Subjects		
GEOG9210	Computer Mapping and Data Display	12
GEOG9240	Principles of Geographical Information Systems	12
GEOG9241	Advanced Geographical Information Systems	12
GEOG9250	Special Topic	12
GEOG9280	Applications and Management of GIS	12
GEOL0110	Geological Remote Sensing*	12
GEOL0310	Image Processing of Spatial Data Sets	12
GEOL0360	Remote Sensing Applications in Geoscience	12
GMAT9530	Analytical Photogrammetry	12
GMAT9532	Data Acquisitions and Terrain Modelling	12

**Students who take GEOL0110 are precluded from taking GEOL0310 and GEOL0360.*

Note: Other subjects may be substituted for those listed with permission of the Course Coordinator to suit the specific needs of individual students.

5047.2000
Remote Sensing

Graduate Diploma
GradDip

The graduate diploma program in Remote Sensing is offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either faculty depends on the background of the applicant and the orientation of the proposed program.

Entry qualifications. Three-year degree from an approved university and or qualifications deemed appropriate by the relevant faculty.

Course requirements. Candidates are required to complete a program totalling a minimum of 82.5 credits or equivalent to 12 hours per week for two sessions of full-time study, made up of compulsory subjects (60 credits) and elective subjects (a minimum of 22.5 credits). Compulsory subjects not offered in a particular year may be substituted by an approved equivalent subject.

The course will normally comprise one year of full-time study or two years part-time study. One-third of the credits

for elective subjects may be from approved undergraduate subjects.

Compulsory Subjects		CP
GEOG9150	Remote Sensing Applications	12
GEOG9290	Image Analysis in Remote Sensing	12
GMAT9600	Principles of Remote Sensing	12
GMAT9605	Field Data Collection and Integration	12
GMAT9606	Microwave Remote Sensing	12

Elective Subjects (12 credit points)
From the following (or as approved by the relevant Faculty):

CIVL9859	Environmental Hydrology	12
CIVL9861	Environmental and Engineering Geophysics	12
CIVL9875	Hydrological Processes	12
ELEC9408	Computer Display Systems and Interactive Instrumentation	12
GEOG9160	Directed Problems in Remote Sensing	12
GEOG9210	Computer Mapping and Data Display	12
GEOG9240	Principles of Geographic Information Systems	12
GEOL0110	Remote Sensing in Applied Geology	12
GEOL9060	Environmental Geology	12
GMAT9211	Introduction to Geodesy	12
GMAT9532	Data Acquisition and Terrain Modelling	12
GMAT9604	Land Information Systems	12

Graduate Programs in Environmental Studies

8045
Environmental Studies

Master of Environmental Studies
MEnvStudies

This is an interdisciplinary course designed to study the nature of environmental problems and the methodology of evaluation. Emphasis is placed on the development of relevant skills in environmental analysis, management and planning.

See entry under Safety Science

8047.3000
Environmental Management

Master of Applied Science
MAppSc

The Masters degree program in environmental management provides an opportunity to focus on the management of key natural resources, particularly soils, rivers, and vegetation. Emphasis is also placed on the application of information technology for planning and decision making.

Entry qualifications. Four year degree of appropriate standard in geography, environmental science, engineering, or in a relevant biological or agricultural science.

Course requirements. Candidates are required to complete a course of study totalling a minimum of 104 credits made up of compulsory subjects (36 credits), a project (36 credits), and elective subjects (a minimum of 32 credits). Compulsory subjects not available in a particular year may be substituted by an equivalent subject, approved by the Course Coordinator. The degree will normally comprise one year of full-time study or two years of part-time study. Students will be expected to devote an additional 15 hours per week outside lectures and practical classes to independent study, fieldwork, and completion of assignments.

Compulsory subjects		CP
GEOG9300	Vegetation Management	12
GEOG9310	River Management	12
GEOG9320	Soil Degradation and Conservation	12
GEOG9509	Project	36

Elective Subjects (12 credit points)*

GEOG9150	Remote Sensing Applications	12
GEOG9240	Principles of Geographic Information Systems	12
GEOG9241	Advanced Geographic Information Systems	12
GEOG9250	Special Topic	12
GMAT9600	Principles of Remote Sensing	12
SAFE9273	Environment and Law	8

**Alternative subjects may be substituted with the permission of the Course Coordinator.*

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organisational units. Note that due to on-going course changes some subjects offered in Year 2 have 3000 numbers and vice versa. 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.

GEOG1000
Field Project 1
Staff Contact: Dr B Parolin
CP10 F T4

A five days field project normally undertaken during the mid-year recess, designed to support teaching in Year 1 subjects and to develop basic field methods and skills. Students will incur some personal expenses in connection with this subject, which is a compulsory part of the course.

GEOG1022
Locational Processes
Staff Contact: Dr B Parolin
CP10 S2 L2 T2

Basic theoretical constructs for explaining the location of human activity. Concepts of optimal location and spatial competition, geographical variations in the factors of production, economies of scale and agglomeration, transaction costs and locational decision making under conditions of uncertainty. Practical study links theory and problem solving in economic geography.

GEOG1031
Environmental Processes
Staff Contact: Mr D Edwards
CP15 S2 L3 T1
Note/s: Excluded GEOG1073.

The subject is an introduction to physical geography outlining the processes and history of physical and biological components of the environment. This knowledge is then used to improve our understanding of global environmental problems. Aspects of the environment considered include the Earth's energy balance, atmospheric systems, ecosystems, soils and erosion processes.

GEOG1043
Data Processing Systems
Staff Contact: Mr S Filan
CP10 S1 L2 T2

Measurement, management, analysis and display of general and spatial data. Basic use of the University's campus wide network, predominantly with personal computers. Use of software (particularly SPSS for windows) for management, processing, analysis and display of data.

GEOG1044
Data Display Systems
Staff Contact: Prof B Garner
CP10 S2 L2 T2
Prerequisite: GEOG1043

Graphic information processing. Data display in tables, graphs, diagrams and maps. Thematic mapping. Effective use of colour and shading. Design principles and use of symbolism. Multiple-feature displays. Data entry and digitising. Graphics production, thematic mapping and computer-assisted cartography using appropriate software.

GEOG1062
Australia and Global Development
Staff Contact: A/Prof I Burnley, Dr M Sant, Ms B Scott
CP15 S1 L2 T2
Note/s: Students will incur personal costs. Excluded GEOG1064.

Progressive integration of Australia into global capitalism and developmental and environmental consequences of this process in Australia and Pacific Rim countries and adjacent territories. Colonial and dependent development in Australia and resource use; applications of recent development theory as applied to core periphery relationships between world financial centres and Australia, and between Australia and Pacific Island territories; transnational organisations and technology transfer and investment in Australia and Pacific countries; the relationships amongst changing trade patterns, production and development in Australia and Pacific Rim countries; Australia in a future world.

GEOG1063
Development, Resources and Environment in Australia
Staff Contact: Mr K Dunn, A/Prof I Burnley, A/Prof M Fox
CP7.5 S1 L2
Note/s: Excluded GEOG1064.

Relationships between economic development, resource utilisation and the environments of Australia, emphasising the period since the Second World War. Impacts of specific economic imperatives, population growth and patterns of production and consumption on resources, land degradation, and flora and fauna in Australia. Perspectives on the sustainability of development and environmental protection and the role of political factors and management quality in this. Settlement types and the environment.

GEOG1064
Global Development, Economy and Environment in Australia
Staff Contact: A/Prof I Burnley, Dr M Sant, Mr K Dunn
CP20 S1 L4 T2
Note/s: Students will incur personal costs. Excluded GEOG1062.

Progressive integration of Australia into global capitalism and developmental and environmental consequences of this process in Australia and adjacent territories. Colonial and dependent development in Australia and resource use; applications of recent development theory as applied to core periphery relationships between world financial centres and Australia, and between Australia and adjacent territories; transnational organisations and technology transfer and investment in Australia and relationships amongst changing trade patterns, production and development in Australia. Impacts of specific economic imperatives, population growth and patterns of production and consumption on resources, land degradation and flora and fauna in Australia. Role of political factors and

management quality in sustainable development and environmental protection.

GEOG1073
Environmental Processes and Analysis
Staff Contact: Mr D Edwards
CP15 S2 L3 T3
Note/s: Excluded GEOG1031.

This subject has the same content as GEOG1031 but with an additional 2 hour laboratory introducing methods of analysis of climates, soils, hyrology, landforms and vegetation.

GEOG2000
Field Project 2
Staff Contact: A/Prof M Fox (Physical)
Dr M Sant and Mr S Filan (Economic)
CP10 F T3
Note/s: Students will incur personal costs.

A five days field project normally undertaken during a recess designed to support teaching in Year 2 subjects in physical and economic geography and to develop more advanced skills in data collection, observation and field methods. Students will incur some personal expenses in connection with this subject, which is a compulsory part of the course.

GEOG2013
Geographical Data Analysis
Staff Contact: Mr D Edwards
CP15 S1 L1 T3
Prerequisite: Either GEOG1073 or both GEOG1031 and GEOG1062

Inferential statistics and hypothesis testing in the analysis of spatial data. Methods of sampling, comparing populations and of identifying relationships through correlation, association, regression, time series and classification. Topics covered are applicable to physical and economic geography.

GEOG2021
Introduction to Remote Sensing
Staff Contact: Mr A Evans
CP15 S2 L2 T2
Prerequisite: Successful completion of a Year 1 program in Applied Science, Science or Arts or equivalent as approved by the Head of School

Principles and technical aspects of remote sensing. Forms of available imagery, their utility and facilities for interpretation. Basic airphoto interpretation techniques relevant to environmental assessment. Introduction to principles of the electromagnetic spectrum, photometry and radiometry. Sensor types, image formation and end products associated with selected satellite programs, including Landsat. Land-cover and land-use interpretation procedures in visual image analysis. Basic procedures in machine-assisted image enhancement.

GEOG2025
Biogeography
Staff Contact: A/Prof M Fox
CP15 S2 L2 T2
Prerequisites: GEOG1073 and both BIOS1011 and BIOS1021

Distribution of taxa. Floras of the Southern Hemisphere with particular reference to Australia. Endemic, discontinuous and relict taxa. Dispersal and migration of species. Origin, evolution and geological history of Angiosperms. The development of the Australian biogeographic element. Study of the recent past to understand present distributions of taxa. The role of humans and climatic change on Australian vegetation. Detection of pattern and association and their causes. Classification, ordination and mapping of vegetation. Ecology of selected Australian vegetation types. Management of vegetation in different climate regimes.

GEOG2051
Soils and Landforms
Staff Contact: Dr W Erskine
CP15 S1 L2 T2
Prerequisite: GEOG1031 or GEOG1073

An introduction to soil classification schemes with particular emphasis on the soils and landforms of flood-plains and the Riverine Plain, NSW. Long term development of landscapes with emphasis on the evolution of mountain ranges. Arid zone and coastal landforms emphasising current processes and Quaternary history.

GEOG2052
Project in Spatial Analysis
Staff Contact: Dr M Sant, Mr S Filan
CP10 S2 L1 T3
Prerequisite: GEOG1022

Supervised application of quantitative methods in selected projects involving the analysis of spatial data and requires integrated applications of skills in data processing, geographic data analysis, and mathematical methods.

GEOG2061
Regional Theory
Staff Contact: Dr M Sant
CP15 S1 L2 T2

Regional theory and analytical methods with a particular focus on the explanation of the Richardson growth model and the practical application of its components, using Australian data. Capital formation and mobility, labour supply and technological change, assessments of recent changes in the Australian regional economic system. Practical work deals with the measurement and analysis of structural change, accessibility and economic interaction and regional economic welfare.

GEOG2071
Transport and Land Use
Staff Contact: Dr B Parolin
CP15 S2 L2 T2

The relationships between transport and land use, mobility, accessibility, and activity systems in urban and rural environments. Emphasis on policy issues and case studies from Australia. Introduction to simple transport-land use models.

GEOG2092
Australian Social and Economic Landscapes
Staff Contact: A/Prof I Burnley
CP15 S1 L2 T2
Prerequisite: GEOG1062

Analysis of the principal factors and forces shaping the contemporary social and economic landscapes of Australia and the problems arising. Themes include Australia's changing population profile and distribution, the changing

face of Australian cities, regional disparities in social and economic well-being, changing patterns of employment and industrial location, and the declining fortunes of rural Australia. Planning and policy responses to the problems of spatial change and re-organisation are emphasised and future scenarios addressed.

GEOG3000
Field Project 3
Staff Contact: A/Prof M Melville (Physical), Prof B Garner and Dr B Parolin (Economic)
CP15 F T3
Prerequisite: One of GEOG2025, GEOG3011, GEOG3025. This prerequisite does not apply to students registered in course 3010
Note/s: Students will incur personal costs.

A five days field project normally undertaken during a recess, designed to support teaching in Year 3 Level III subjects in physical and economic geography and to demonstrate the application of field methods in problem solving and research projects. Students will incur some personal expenses in connection with this subject, which is a compulsory part of the course.

GEOG3011
Pedology
Staff Contact: A/Prof M Melville
CP15 S1 L2 T2
Prerequisites: GEOG1073 and one of CHEM1101 or CHEM1401 or both GEOL1101 and GEOL1201 or both BIOS1011 and BIOS1021

Methodology of pedogenic studies and the application of these studies to the understanding of soil and form relationships. Soil physical and chemical properties and their interrelationships, emphasizing clay-mineral structure and behaviour, soil solution chemistry, soil water movement and the application of these properties to elements of soil mechanics. Soil properties in natural, rural and urban landscapes, including assessment of soil fertility, swelling characteristics, dispersibility, erodibility and aggregate stability. Laboratory analysis of soil physical and chemical characteristics with emphasis on properties associated with land capability assessment. Statistical analysis of soil data and its application to mapping. The use of soil micromorphological and mineralogical studies in pedology.

GEOG3025
Geomorphology
Staff Contact: Dr W Erskine
CP15 S2 L2 T2
Prerequisites: GEOG2051

Drainage basin processes including: weathering, the production of runoff and sediment, sediment tracing, sediment budgets and denudation histories. The processes of river channel changes including sediment transport, hydraulics, hydrology, hydraulic geometry and channel patterns. There will be an emphasis on the application of geomorphic principles to land management.

GEOG3032
Remote Sensing Applications
Staff Contact: Mr A Evans
CP15 S1 L2 T2
Prerequisite: GEOG2021 or GMAT8711

Spectral characteristics of natural phenomena and image formation. Ground truthing, collection and calibration. Introduction to computer classification procedures. Multi-temporal sampling procedures, image to image registration and map to image registration. Major applications of remote sensing in the investigation of renewable and non-renewable resources to include: soils, geology, hydrology, vegetation, agriculture, rangelands, urban analysis, regional planning, transportation and route location and hazard monitoring.

GEOG3041
Mathematical Methods for Spatial Analysis
Staff Contact: Mr S Filan
CP15 S1 L2 T2
Prerequisite: MATH1021 or MATH1032 or MATH1231 or MATH1042 or MATH1241 and GEOG1043 or FIBR2201

Selected mathematical methods for the analysis of spatial problems, including applications of calculus in constrained and unconstrained optimisation; mathematical programming methods; network models; input-output analysis; in facility location and allocation problems.

GEOG3042
Environmental Impact Assessment
Staff Contact: Prof B Garner, Dr W Erskine
CP15 S1 L2 T2
Prerequisites: GEOG1031 or GEOG1073 or by permission from Head of School

Rationale and basic objectives; history and legislative framework: standardised types of environmental impact assessment EIA, including matrix approach, adopted methods of EIA in Australia. Techniques of impact evaluation in terms of socio-economic criteria. Environmental decision making and planning under conditions of uncertainty. Case studies exemplifying procedures, techniques and issues. Trends, changes and possible future developments in EIA Practical exercises representing components of typical EIAs.

GEOG3062
Environmental Change
Staff Contact: School Office
CP15 S1 L2 T2
Prerequisite: Successful completion of a Year 2 Progam in Applied Science, Science, or Arts or equivalent as approved by the Head of School

The nature of environmental change on the land, oceans, biosphere and atmosphere. Evolution of the continents, oceans, life and atmosphere. Techniques for environmental reconstruction and chronology building. Quaternary climatic change and modelling. Human impact on the atmosphere and climatic consequences.

GEOG3082
Project Design and Formulation
Staff Contact: Dr B Parolin
CP10 S2 L2 T2

Stages in the design of a research project. Undertaking a literature review relating to the project. Identification and formulation of working hypotheses. Writing up a research

proposal. Timetables and planning strategies for project execution and completion.

GEOG3101
Sample Surveys and Analysis
Staff Contact: Dr B Parolin
CP10 S1 L2 T2

An introduction to sample survey data collection methods and techniques for the analysis of survey data. Topics include research design methods, questionnaire design and implementation and the analysis of categorical survey data using log-linear, logit and regression approaches.

GEOG3122
Geographic Information Systems
Staff Contact: Prof BJ Garner, Mr S Filan
CP15 S2 L2 T2
Prerequisite: Successful completion of at least one year of course 2700.0600 Computer Science or course 2700.1400 Information Systems, or by permission from the Head of School.
Note/s: Enrolments in this subject are constrained by availability of laboratory facilities. All enrolments must be approved by the Head, School of Geography, or representative.

An introduction to geographic information systems with special reference to computer-based systems for resource evaluation. Case study evaluation, application of the MAP and other GIS software.

GEOG3123
Applied Geographic Information Systems
Staff Contact: Prof BJ Garner, Mr S Filan
CP15 S2 L2 T2
Prerequisite: Successful completion of at least three subjects offered by the School of Geography, or by special permission from the Head of the School of Geography, or representative.

An introduction to information systems of particular relevant for geographers with special reference to computer-based systems for resource evaluation. Case study evaluation, application of the MAP and other GIS software.

GEOG3132
Marketing Geography
Staff Contact: School Office
CP15 S1 L2 T2
Prerequisite: MARK2042. This prerequisite does not apply to students enrolled in course 3010.
Note/s: Subject to availability of staff.

Organisation and operation of the marketing function and trends in its performnance. Merchandising strategies of wholesalers and retailers and the consequent location patterns of consumer oriented enterprises within cities. Retail feasibility studies and the structure and analysis of market areas in intra-urban areas. Consumer spatial behaviour, including search and decision processes. Shopping centre images and spatial choice models.

GEOG3142
Geographic Information Systems Applications
Staff Contact: Dr Q Zhou
CP15 S2 L2 T2
Prerequisite: GEOG3122

Examples of applications of geographical information systems in resources and environmental management and urban and regional analysis. Case studies include the monitoring of land degradation, management of biological and physical resources, environmental conflict resolution, administration of land records, provision of health services, transport and land use planning, marketing and territory assignment. Visits to inspect facilities and activities of key government agencies are included.

GEOG3152
Social Welfare and Urban Development
Staff Contact: Mr K Dunn
CP15 S2 L2 T2
Prerequisite: GEOG2092. This prerequisite does not apply to students enrolled in course 3010.

A consideration of the welfare aspects of urban development, including social policies and urban structure; social costs and benefits of urban renewal especially in the inner city; growth centres and new towns; distributional aspects of social services and spatial disparities in social well-being.

GEOG3161
Computer Mapping and Data Display
Staff Contact: Prof BJ Garner
CP15 S1 L1 T3
Prerequisites: Successful completion of a Year 1 program in Science or Arts or equivalent as approved by Head of School

Introduction to theoretical and practical problems in displaying data graphically and constructing thematic maps by computer using the MapInfo mapping package. The emphasis is on developing skills in automated cartography through hands-on experience culminating in the preparation of a folio of maps of selected census data. No previous computing expertise is required.

GEOG3172
Spatial Population Analysis
Staff Contact: A/Prof I Burnley
CP15 S2 L2 T2
Prerequisite: GEOG2092

Population growth and structure in an international urban and regional context. The components and processes of population change; fertility, mortality and migration set within the framework of demographic transition and development theory. Theories of migration and mobility and of optimal populations. Demographic and social indicators for urban and regional analysis and their implications for inequalities in living conditions, at local, regional, and international scales. The adjustment of immigrant and migrant populations to the urban environment.

GEOG3181
Urban Activity Systems
Staff Contact: Dr B Parolin
CP15 S1 L2 T2
Prerequisite: GEOG2092

Focus is on trip making, movement, and activity patterns in urban areas. Topics include: the activity concept, travel behaviour and urban spatial structure; constraints to individual travel behaviour and activity pattern linkages; the urban transport disadvantaged; public transport problems and issues in Australian capital cities; travel and activity consequences of transport infrastructure developments.

GEOG3192
Urban and Regional Development
Staff Contact: Dr M Sant
CP15 S2 L2 T2

Prerequisite: GEOG2092

Focus is on the growing importance of recreation and tourism in urban and regional systems. Emphasis is on problems of land use and resource allocation and implications for planning in Australia. Theoretical and practical studies of leisure environments, open space provision, recreational demand, methods of forecasting, management of supply, resort development, economic and environmental impact assessment.

GEOG3211
Australian Environment and Natural Resources
Staff Contact: A/Prof M Fox
CP15 S1 L2 T2
Prerequisite: GEOG1073 or GEOG1031

The characteristics of Australia's physical and biotic environment: geology, climate, geomorphology, soils, vegetation and fauna. The problems of exploiting Australia's water and land resources including the degradation of land by erosion, salinisation and soil fertility decline; and habitat loss and fragmentation.

GEOG3333
Special Topic
Staff Contact: A/Prof M Fox
CP15 F T4

Admission by permission to suitable students with good passes in at least four subjects at Upper Level. A course of individually supervised reading and assignments as an approved topic in Geography not otherwise offered.

GEOG3334
Special Research Methods
Staff Contact: A/Prof I Burnley
CP15 F T2
Prerequisite: A graded pass average in at least four upper level geography subjects
Note/s: Excluded GEOG3333

A course of individually supervised readings leading towards an advanced understanding of theoretical and analytical developments in one area of geography.

GEOG4010
Field Project 4
Staff Contact: Dr W Erskine
CP20 S2 T8

Develop skills in problem formulation and team-based field work. Preparation and presentation of professional quality reports of applied geographical analysis. Define problem, plan strategy for appropriate investigation. Conduct field studies, and report results of investigation. Field work of five days is compulsory. Students will incur some personal expenses in connection with this subject.

GEOG4031
Project
Staff Contact: Dr B Parolin
CP40 S1 T16
Prerequisite: GEOG3082

Implementation of the research proposal in Applied Geography prepared for GEOG3082 Project Design and Formulation under the direction of a supervisor; preparation of a project report.

GEOG4042
Practical Applications in Geography
Staff Contact: Prof BJ Garner
CP10 S2 T4

Seminars with practitioners in the fields of urban and regional analysis and environmental studies including environmental impact statements; research proposals, report writing, the roles of government agencies and consultants; and budgeting for research projects; applying for positions and personal skills development.

GEOG4100/GEOG4050
Honours Geography
Staff Contact: A/Prof I Burnley (Arts), Dr A Skidmore (Science)
CP120/60 F
Prerequisites: Arts students must satisfy Faculty requirements for entry to the Honours Level program and must have obtained at least135 credit points in Geography subjects, including 30 Level 1 credit points and must include GEOG2013. A minimum cumulative average at Credit level is required for all Upper Level subjects taken.

Science students must have completed either program 2700, 2527 or 6851 including GEOG2013 and 120 Level III credit points.

Students are required: 1. To undertake an original piece of work extending throughout the year and to submit a thesis based upon it. 2. To participate in seminars and fieldwork as notified by the School of Geography.

GEOG4052
Advanced Spatial Analysis
Staff Contact: Dr B Parolin
CP15 S1 L2 T2
Selected topics in economic and physical geography chosen to illustrate developments at the frontiers of research in spatial analysis.

GEOG4062
Advanced Environmental Analysis
Staff Contact: A/Prof M Melville
CP15 S1 L2 T2

Selected topics in the study of human and physical environments, chosen to illustrate contemporary frontiers of research and development in environmental studies.

GEOG4300
Vegetation management
Staff Contact: A/Prof M Fox and Dr A Skidmore
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.

GEOG4310
River management
Staff Contact: Dr W Erksine
CP15 S2 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 principles of river management including total or integrated catchment management, environmental impact assessment, in-stream uses and hydrogeomorphic behaviour. Issues covered include regulated rivers, inter-basin diversions, extractive industries, urbanisation, river engineering, legislative controls and institutional responsibilities. The course develops an understanding of how and why rivers respond to human activities and ways of ameliorating negative impacts. Field work is an essential part of the subject and the Nepean River will be used as a case study of management problems.

GEOG4320
Soil Degradation and Conservation
Staff Contact: A/Prof M Melville and Dr W Erksine
CP15 S2 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.

Identification, assessment and analysis of the main processes of soil degradation, including the role of climate, vegetation, geomorphology and pedology in controlling the processes. Discussions of appropriate management strategies for reducing degradation and for reclaiming degraded landscapes. Topics include: surface wash, gully erosion, wind erosion, soil acidification, soil structure decline, salinisation, accumulation of toxins and desertification.

GEOG9130
Soil Studies for Arid Lands Management
Staff Contact: A/Prof M Melville
CP12 S1 L2 T1

Soil forming processes in arid regions. Physical, mineralogical and chemical characteristics of arid soils, with emphasis on properties significant for land capability. Chemical and physical properties of saline and alkaline soils. Soil response to irrigation, secondary salinisation and alkalinisation. Classifications and distribution of arid zone soils and their environmental relationships. Field methods and soils survey techniques, statistical analysis of soil data and its application to mapping. Laboratory analyses of physical and chemical characteristics of soils, with emphasis on properties significant for land capability.

Based on GEOG3011 Pedology, with additional reading, tutorials, seminars and practical classes to stress the features of arid zone soils.

The formal component of the above teaching is completed at Kensington. However, a number of tutorial and laboratory hours are devoted to a field-based soil mapping project based at Fowlers Gap Research Station.

GEOG9150
Remote Sensing Applications
Staff Contact: Dr A Skidmore and Mr A Evans
CP12 S1 L1 T2

The application of remotely-sensed data and information in the description, classification and assessment of earth resources and environmental conditions. Different types of remote sensing data and imagery, their attributes, acquisition and uses. Relevance of remote-sensing data and imagery to a range of applications, including assessment of conditions of terrain, soils and surface materials; multi-temporal monitoring and inventory of rangelands, croplands and forests; rural and urban land use assessment; surveillance of surface water resources and sedimentation; appraisal of changes in the coastal zone. Use of remote sensing in environmental management and in environmental impact assessment.

GEOG9160
Directed Problems in Remote Sensing
Staff Contact: Dr A Skidmore
CP12 S2 T3

A detailed investigation of a particular aspect of remote sensing technology or an area of applications relevant to candidates interests and background.

GEOG9210
Computer Mapping and Data Display
Staff Contact: Prof B Garner
CP12 S1 L2 T2

Introduction to automated cartography and thematic mapping; theoretical and practical problems in displaying and mapping data by computer; review and application of selected computer mapping packages. INFO is used for database management, and ARCINFO and MapInfo for cartographic manipulation and output.

GEOG9230
Population, Health and Environment
Staff Contact: A/Prof I Burnley
CP12 S2 L2

Relationship between environmental factors and disease morbidity and mortality is examined by consideration of the epidemiological transition in different countries, and the spatial and occupational-specific variation in disease incidence in Australia. Methodology for standardising, testing for significance and data quality.

GEOG9240
Principles of Geographic Information Systems
Staff Contact: Prof B Garner
CP12 S1 L1 T2

Study of selected geographic information systems; problems of data capture and display, data storage and manipulation, system design and development; cartographic displays and computer mapping. INFO is used for database management, and ARCINFO and MAP for spatial data manipulation and display.

GEOG9241
Advanced Geographical Information Systems
Staff Contact: Dr A Skidmore
CP12 S2 L1 T2
Prerequisite: GEOG9240

Advanced topics and concepts in GIS research and development. Focus is primarily on vector-based systems. Topics include data models, structures and capture; vector editing and algorithms; errors and data accuracy. Practical exercises based on ARCINFO; INFO is used for data base management.

GEOG9250
Special Topic
Staff Contact: Prof B Garner
CP12 S1 or S2 T3

Selected topics may be pursued in the forum of individually supervised readings and assignments linked to studies in postgraduate programs offered through the School of Geography.

GEOG9280
Application and Management of Geographical Information Systems
Staff Contact: Dr A Skidmore
CP12 S1 L2 T1

The process and issues involved in an organisation acquiring, implementing and managing a GIS will be considered using real examples. Applications using GIS in the management of natural resources (forest, park, soil etc), utilities and cadastra at the local, national and global scale will be critically reviewed. The course will involve the practical use of project management tools and the application of GIS to solve a management problem using ARCINFO or MapInfo is used for database management.

GEOG9290
Image Analysis of Remote Sensing
Staff Contact: Dr A Skidmore, Mr A Evans
CP12 S2 L1 T1

Techniques for extracting information from satellite imagery including image enhancement techniques, classification and feature recognition, statistical methods, and related procedures. Emphasis is on applications relating to vegetation cover and natural resource management. Practical work will be undertaken using the ERDAS image processing software.

GEOG9300
Vegetation management
Staff Contact: A/Prof M Fox, Dr A Skidmore
CP12 S1 L2 T1
Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

The subject provides a background in theory and practice in vegetation management, particularly under Australian conditions. It covers the description and measurement of vegetation, vegetation dynamics, vegetation response to perturbation and human impacts, theories, and modelling of vegetation change. A third of the subject is devoted to management strategies of selected vegetation types.

GEOG9310
River management
Staff Contact: Dr W Erksine
CP12 S2 L2 T1
Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

The principles of river management including total or integrated catchment management, environmental impact assessment, in-stream uses and hydrogeomorphic behaviour. Issues covered include regulated rivers, inter-basin diversions, extractive industries, urbanisation, river engineering, legislative controls and institutional responsibilities. The course develops an understanding of how and why rivers respond to human activities and ways of ameliorating negative impacts. Field work is an essential part of the subject and the Nepean River will be used as a case study of management problems.

GEOG9320
Soil Degradation and Conservation
Staff Contact: A/Prof M Melville, Dr W Erksine
CP12 S2 L2 T1
Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

Identification, assessment and analysis of the main processes of soil degradation, including the role of climate, vegetation, geomorphology and pedology in controlling the processes. Discussions of appropriate management strategies for reducing degradation and for reclaiming degraded landscapes. Topics include: surface wash, gully erosion, wind erosion, soil acidification, soil structure decline, salinisation, accumulation of toxins and desertification.

GEOG9330
Spatial Data Processing and Integration
Staff Contact: Dr Q Zhou
CP12 S1 L1 T2
Note/s: Not offered in 1996.

Geographical information systems and remote sensing have many similarities, including geometric rectification, incorporation of reference data into the analysis of GIS and remotely sensed data, accuracy assessment, the form and structure of the data, visual analysis of spatial data and digital processing methods (Boolean overlay, decision support systems, affined transformations and expert systems). These topics will be considered and applied in the laboratory using remotely sensed and GIS data. INFO is used for database management and ARCINFO, ERDAS and MAP to demonstrate the practical application of the topics.

GEOG9509
Project
Staff Contact: A/Prof M Melville
CP36 S2 T9

A practical application or investigation in environmental studies or in land classification as a basis for land management or land use planning: or an investigation of soil degradation in relation to soil-vegetation characteristics and land use; or a comparative review of existing approaches to land evaluation. Involves preparation of a report, and fieldwork at Fowlers Gap Research Station or in another part of arid or semi-arid Australia. Tutorial hours are equivalent contact hours, but also involve fieldwork out of session.

GEOG9512
Project
Staff Contact: Prof B Garner, Dr A Skidmore, Dr Q Zhou
CP48

An investigation of a problem in remote sensing or geographical information systems which involves an identifiable research component. Such an investigation should be related to the research interests of particular Schools within the Faculty of Applied Science.

School of Materials Science and Engineering

Head of School
Professor DJ Young

Administrative Assistant
Mr O S Andersen

The field of Materials Science and Engineering offers unlimited possibilities for innovation and development. Attention is being focussed on developing and processing metals, ceramics, polymers and composites with improved properties. The activities of the materials engineer range from materials production, including their extraction from ores and their refining, to the design, development, processing and recycling of materials for use in aerospace, transportation, electronics, energy conversion, and biomedical systems. Advanced materials can provide a major competitive advantage in virtually every part of a country's manufacturing industry. Because Australia is a country rich in minerals, materials science has been designated as a priority area for research and development. Examples of recent and significant developments include the emergence of environmentally friendly and economical metal processing methods; advanced surface coatings; electrical ceramics; engineering polymers, and advanced composites.

The School of Materials Science and Engineering provides education and training for students to prepare them for a significant and important career in the materials industry.

The School of Materials Science and Engineering is in a good position to provide the increased numbers of graduates necessary for development of these new initiatives in materials. It is the only school in Australia which offers professional courses in ceramic engineering, metallurgical engineering, and materials engineering as well as providing postgraduate specialisation in these fields. The School is extremely well equipped with a wide range of advanced computing, thermal analysis, mechanical testing, X-ray, optical and electron microscopy facilities.

The School comprises three departments, ceramic, materials, and metallurgical engineering which offer the above-mentioned undergraduate courses.

Ceramic Engineering and Ceramics

The ceramic industry produces an enormous volume and variety of products used in engineering applications, building construction and in our everyday life. As well as the traditional bricks, roof tiles, sheet and container glass and tableware, ceramics have been found essential as abrasives, refractories, enamels and in electrical and electronic applications and nuclear fuels. In many of these cases, ceramic articles make possible the manufacture of other products either by being a key component, such as an electronic or magnetic part, or by forming the material of construction of, for example, a blast furnace or an abrasive wheel. Modern ceramics comprise such a varied and complex group of materials that a high level of training is required to control their manufacture with the required precision and to supervise their proper use. Ceramic engineers are needed in increasing numbers both in Australia and overseas countries and the School offers the only degree course in Ceramic Engineering in Australasia. The Ceramic Engineering course trains students in the relation between the structure and the properties of ceramic materials, the engineering and process chemistry of their manufacture and the design principles of their use. Careers open to graduates fall into three broad categories. Some go initially into activities associated directly with production, i.e. the design and layout of plants, supervision of their construction and control of their operations. Others move into research and development in industrial laboratories or research institutions. The final group enters fields outside

of Ceramic Engineering directly, where the graduate's background in materials and engineering is utilised. In all cases, graduates with organising ability frequently move into management if they have an interest in this side of the industry.

In Australia, a number of government research organisations are active in ceramic research, e.g. the Australian Nuclear Science and Technology Organisation, and the Divisions of Materials Science and Building Research of the CSIRO. Investigations with more immediate applications are carried out in industrial laboratories. Even when the basic principles of a process have been worked out in the laboratory, its successful transfer to an industrial scale requires a great deal of effort and expertise. This is an area which offers great scope for further development in Australia.

Graduates in Ceramic Engineering are eligible for membership of the Institution of Engineers, Australia, the Institute of Ceramics, Great Britain, the Royal Australian Chemical Institute and the National Institute of Ceramic Engineers, USA

It is compulsory that, before completion of the course, students in Ceramic Engineering must obtain a minimum of twelve weeks' professionally oriented or industrial experience.

Metallurgical Engineering

The metallurgical profession has developed in importance in keeping with growth of Australian metal and mineral industries. These industries are recognised as being important to the Australian economy and there is a strong demand for professional metallurgists in all sectors of these industries, as well as in the manufacturing industry.

Graduate metallurgists have a wide choice of type of employment and location. They may work in production, technical control or development, in metal or mineral producing plants in locations such as Newcastle, Port Kembla, Broken Hill, Mt Isa, Townsville, Gladstone, Port Pirie, Whyalla, Kwinana, Kalgoorlie or Pilbara; or in manufacturing plants, including the automobile, aircraft, and construction industries located mainly in the population centres. In the metal industry, opportunities for a career in management are excellent, since it is a tradition in this industry that management should be in the hands of technical people. If graduates are inclined towards research and development, they will find considerable scope in various government, university, and industrial research laboratories.

The undergraduate courses in metallurgical engineering and metallurgy are broadly-based on engineering and physical sciences and have been designed to prepare graduates for employment in any field of metallurgy within the metal and manufacturing industries or in research institutions.

Graduates in Metallurgical Engineering are eligible for membership of the Institution of Engineers, Australia, the Australasian Institute of Mining and Metallurgy and the Institution of Metals and Materials Australasia.

Students are required to have gained at least twelve weeks of approved industrial experience before graduation. Industrial experience is usually obtained during the long recess periods.

Materials Engineering

Materials Engineering is a new and broad-ranging discipline which applies the principles of science and engineering to the design and development of metallic, ceramic and plastic materials and, to their manufacture into goods and their subsequent performance in service. It is founded on the relationship between structure and properties, an understanding of which permits materials to be engineered to specific end use requirements. Virtually every man-made material is now the subject of study of the Materials Engineer.

Due to an increasing demand for optimised materials, graduates in Materials Engineering are presented with an outstanding range of job opportunities. Many graduates pursue an industrial career either in the materials producing industries, the utilities, or manufacturing sector. Materials and process development and selection, supervision of manufacturing and production processes, technical trouble shooting and testing, are areas in which Materials Engineers are commonly engaged. Alternatively, graduates may pursue a research career, working in laboratories run by materials producing companies, and statutory commonwealth and state government departments. Graduates with an organising ability frequently move into management both in industry and research. Since materials engineering is a broadly-based scientific/engineering discipline, there is considerable flexibility in career selection.

Graduates in Materials Engineering are eligible for membership of the Institution of Engineers, Australia.

Students are required to have gained at least twelve weeks of professionally oriented or industrial experience in an area of industrial setting involving processing, production, characterisation, analysis, testing etc.

Undergraduate Study

Course Outlines

Ceramic Engineering and Ceramics

A four-year full-time course in Ceramic Engineering leading to the award of the BE degree, and a six-year part-time course in Ceramics leading to the award of the BSc (Tech) degree, are offered within the School.

3025
Ceramic 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
MATH1131	Mathematics 1A *or*			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	15
MATS1001	Introduction to Materials Industry	2	0	5
MATS1011	Introduction to Materials Engineering	1	0	2.5
MATS1021	Introduction to Computing	0	2	5
MECH0130	Engineering Drawing and Descriptive Geometry	4	0	10
MECH0440	Engineering Statics	0	3	7.5
PHYS1002	Physics 1	6	6	30
Total HPW Session 1		**25**		
Total HPW Session 2		**23**		
Total Credit Points		**120**		

		HPW S1	HPW S2	CP
Year 2				
CHEM2818	Physical Chemistry	5	0	12.5
MATH2021	Mathematics	2	2	15
MATS1002	Microstructural Analysis	0	3	7.5
MATS1022	Materials Process Principles	0	1	2.5
MATS1032	Materials Engineering 1A	3	0	7.5
MATS1042	Crystallography and X-Ray Diffraction	4	0	10
MATS1052	Materials Engineering 1B	0	3	7.5
MATS1062	Mechanical Properties of Materials	4	0	10
MATS1072	Physics of Materials	3	0	7.5
MATS1082	Thermodynamics of Materials 1	0	3	7.5
MATS1092	Materials and Design 1	0	2	5
MATS1102	Numerical Methods	1	2	7.5
MATS1112	Phase Equilibria	0	2	5
General Education subject/s		0	4	15
Total HPW Session 1		**22**		
Total HPW Session 2		**22**		
Total Credit Points		**120**		

		HPW S1	HPW S2	CP
Year 3				
FUEL0040	Fuel Engineering for Ceramic Engineers	1	1	5
INDC3070	Instrumentation and Process Control 1	0	3	7.5
MATH2869	Statistics SC	2	0	5
MATS1093	Thermodynamics of Materials 2	2	0	5
MATS1113	Ceramic Process Principles 1	2	0	5
MATS1243	Management 1	3	0	7.5
MATS1163	Chemistry of the Solid State	2	0	5
MATS2123	Ceramic Process Principles 2	0	2	5
MATS2133	Ceramic Raw Materials	2	0	5
MATS2143	Ceramic Equipment	0	2	5
MATS2153	Ceramic Processing Laboratory	0	4	10
MATS2183	Refractories	0	2	5
MATS2203	Physico Chemical Ceramics Laboratory	4	0	10
MATS2213	Diffusion	2	0	5
MATS2273	Chemistry of Ceramic Processes	0	2	5
MINE7341	Mineral Process Engineering	2	0	8
General Education subject/s		0	4	15
Total HPW Session 1		**22**		
Total HPW Session 2		**20**		
Total Credit Points		**113**		

		HPW S1	HPW S2	CP
Year 4				
APSE0002	Social Issues in Applied Science	2	0	5
CEIC4010	Process Economics 1	1	0	2.5
CEIC4070	Laboratory Automation for Ceramic Engineers	2	0	5
MATS1244	Management 2	0	4	10
MATS1254	Design Project	1	3	10
MATS1294	Electrical Ceramics	2	0	5
MATS1464	Materials Seminar	1	1	5
MATS1534	Design with Brittle Materials	3	0	7.5
MATS2254	Ceramic Engineering Design	0	2	5
MATS2264	Sintering of Ceramics	2	0	5
MATS2284	Thermal Properties of Ceramics	2	0	5
MATS3524	Project (Ceramic Engineering)	3	9	30
MATS4333	Fracture Mechanics	2	0	5

Total HPW Session 1 21
Total HPW Session 2 19
Total Credit Points 100

3030
Ceramic Engineering - Part-time Course

Bachelor of Science Technology
BScTech

		HPW S1	HPW S2	CP
Stage 1				
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

Total HPW Session 1 12
Total HPW Session 2 12
Total Credit Points 60

Stage 2				
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
MATS1001	Introduction to Materials Industry	2	0	5
MATS1011	Introduction to Materials Engineering	0	1	2.5
MATS1021	Introduction to Computing	0	2	5
MECH0130	Engineering Drawing and Description Geometry	4	0	10
MECH0440	Engineering Statics	0	3	7.5

Total HPW Session 1 12
Total HPW Session 2 12
Total Credit Points 60

		HPW S1	HPW S2	CP
Stage 3				
CHEM2818	Physical Chemistry	5	0	12.5
MATH2021	Mathematics	2	2	15
MATS1072	Physics of Materials	3	0	7.5
MATS1082	Thermodynamics of Materials 1	0	3	7.5
MATS1092	Materials and Design 1	0	2	5
MATS1102	Numerical Methods	1	2	5
General Education subject/s		0	2	7.5

Total HPW Session 1 11
Total HPW Session 2 11
Total Credit Points 60

Stage 4				
MATS1002	Microstructural Analysis	0	3	7.5
MATS1022	Materials Processes Principles	0	1	2.5
MATS1032	Materials Engineering 1A	3	0	7.5
MATS1042	Crystallography and X-ray Diffraction	4	0	10
MATS1052	Materials Engineering 1B	0	3	7.5
MATS1062	Mechanical Properties of Materials	4	0	10
MATS1112	Phase Equilibria	0	2	5
General Education subject/s		0	2	7.5

Total HPW Session 1 11
Total HPW Session 2 11
Total Credit Points 57.5

Stage 5				
FUEL0040	Fuel Engineering for Ceramic Engineers	1	1	5
MATH2869	Statistics SC	2	0	5
MATS1113	Ceramic Process Principles 1	2	0	5
MATS2123	Ceramic Process Principles 2	0	2	5
MATS2133	Ceramic Raw Materials	2	0	5
MATS2143	Ceramic Equipment	0	2	5
MATS2153	Ceramic Processing Laboratory	0	4	10
MATS2203	Physico Chemical Ceramics Laboratory	4	0	10

Total HPW Session 1 11
Total HPW Session 2 9
Total Credit Points 50

Stage 6				
INDC3070	Instrumentation and Process Control 1	0	3	7.5
MATS1093	Thermodynamics of Materials 2	2	0	5
MATS1163	Chemistry of the Solid State	2	0	5
MATS1243	Management 1	3	0	7.5
MATS2183	Refractories	0	2	5
MATS2213	Diffusion	2	0	5
MATS2273	Chemistry of Ceramic Processes	0	2	5
MINE7341	Mineral Process Engineering	2	0	8
General Education subject/s		0	4	15

Total HPW Session 1 11
Total HPW Session 2 11
Total Credit Points 63

Metallurgical Engineering

A four-year full-time course in metallurgical engineering leading to the award of the BMetE degree (Physical Metallurgy or Process Metallurgy Major) and a six-year part-time course in metallurgy leading to the award of the BSc(Tech) degree are offered within the School.

3125
Metallurgical Engineering - Full-time Course

Bachelor of Metallurgical Engineering
BMetE

Students entering the Bachelor Metallurgical Engineering program may elect to major in either Process Metallurgy or Physical Metallurgy. Selection of these alternative study programs may be deferred until the end of the second year of full-time study.

The Process Metallurgy option is designed to produce graduates with training appropriate to the primary metallurgy industry while the Physical Metallurgy option provides a training more suited to the manufacturing industry.

Year 1 of the course consists of physics, chemistry, mathematics and engineering subjects and is essentially the same as that for a number of other engineering and science courses offered in the Faculty of Applied Science. Year 2 introduces Materials Science and Materials Engineering subjects supported by chemistry and mathematics and is common with Year 2 in the full-time Ceramic Engineering and Materials Engineering Courses. Physical Metallurgy and Metallurgical Engineering are introduced in Years 3 and 4. In Year 3 the major strands are supported by other engineering subjects and in Year 4 by a thesis project, seminar and professional electives.

Students are required to have gained at least twelve weeks of approved industrial experience before graduation, and to have submitted satisfactory reports on such work. Industrial experience is usually obtained during the long recess periods at the ends of Years 2 and 3. During the course, visits are made to various metallurgical works, and students are required to submit reports on some of these. Students may complete the first one or two years of their degree at their local university engineering school, and then transfer with advanced standing to UNSW.

		HPW S1	HPW S2	CP
Year 1				
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	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
MATS1001	Introduction to Materials Industry	2	0	5
MATS1011	Introduction to Materials Engineering	1	0	2.5
MATS1021	Introduction to Computing	0	2	5
MECH0440	Engineering Statics	0	3	7.5
MECH0130	Engineering Drawing and Descriptive Geometry	4	0	10
PHYS1002	Physics 1	6	6	30
Total HPW Session 1		**25**		
Total HPW Session 2		**23**		
Total Credit Points		**120**		
Year 2				
CHEM2818	Physical Chemistry	5	0	12.5
MATH2021	Mathematics	2	2	15
MATS1002	Microstructural Analysis	0	3	7.5
MATS1022	Materials Process Principles	0	1	2.5
MATS1032	Materials Engineering 1A	3	0	7.5
MATS1042	Crystallography and X-ray Diffraction	4	0	10
MATS1052	Materials Engineering 1B	0	3	7.5
MATS1062	Mechanical Properties of Materials	4	0	10
MATS1072	Physics of Materials	3	0	7.5
MATS1082	Thermodynamics of Materials 1	0	3	7.5
MATS1092	Materials and Design 1	0	2	5
MATS1102	Numerical Methods	1	2	7.5
MATS1112	Phase Equilibria	0	2	5
General Education subject/s		0	4	15
Total HPW Session 1		**22**		
Total HPW Session 2		**22**		
Total Credit Points		**120**		

		HPW S1	HPW S2	CP
Year 3 (Physical Metallurgy Major)				
MATH2869	Statistics SC	2	0	5
MATS1093	Thermodynamics of Materials 2	2	0	5
MATS1183	Non-Ferrous Physical Metallurgy	2	0	5
MATS1203	Materials and Design 2	2	2	10
MATS1243	Management 1	3	0	7.5
MATS1273	Ferrous Physical Metallurgy A	0	4	10
MATS2213	Diffusion	2	0	5
MATS2223	Phase Transformations	0	3	7.5
MATS4333	Fracture Mechanics	2	0	5
MATS4513	Deformation of Metals	2	0	5
MATS4523	Strengthening Mechanisms in Metals	0	2	5
MATS4533	Metal Forming	2	0	5
MATS4543	Fractrographic Analysis	0	3	7.5
MATS4553	Non-Destructive Testing	0	1	2.5
MATS9650	Pyrometallurgical Processes	0	2	5
General Education subject/s		0	4	15

Total HPW Session 1 19
Total HPW Session 2 21
Total Credit Points 105

		HPW S1	HPW S2	CP
Year 4 (Physical Metallurgy Major)				
APSE0002	Social Issues in Applied Science	2	0	5
MATS1214	Welding and other Joining Processes	2	0	5
MATS1224	Materials Characterisation	1	0	2.5
MATS1234	Heat Resisting Alloys	1	0	2.5
MATS1244	Management 2	0	4	10
MATS1254	Design Project	1	3	10
MATS1264	Fibre Reinforced Plastic Composites	1	0	2.5
MATS1274	Metal and Ceramic Matrix Composites	0	1	2.5
MATS1284	Light Alloys	0	1	2.5
MATS1464	Materials Seminar	1	1	5
MATS3524	Project (Metallurgical Engineering)	3	9	30
MATS4154	Mechanical and Thermal Processing of Metals	1	0	2.5
Professional Electives*		8	0	15

Total HPW Session 1 21
Total HPW Session 2 19
Total Credit Points 95

		HPW S1	HPW S2	CP
Year 3 (Process Metallurgy Major)				
FUEL0050	Fuel Engineering	1	2	7.5
INDC3070	Instrumentation and Process Control 1	0	3	7.5
MATH2869	Statistics SC	2	0	5
MATS1043	Heat, Fluid and Mass Flow in Materials Processing	2	0	5
MATS1093	Thermodynamics of Materials 2	2	0	5
MATS1183	Non-Ferrous Physical Metallurgy	2	0	5
MATS1203	Materials and Design 2 (Unit 1Design for Corrosion Control)	2	0	5
	(Unit 2 Surface Treatment and Wear)	0	2	5
MATS1243	Management 1	3	0	7.5
MATS1283	Ferrous Physical Metallurgy B	0	3	7.5
MATS2183	Refractories	0	2	5
MATS5213	Metallurgical Plant Practice	0	1	2.5
MATS5263	Extractive Metallurgy	3	4	17.5
MATS5314	Kinetics and Mass Transfer in Metallurgical Processes	1	3	10
MINE7341	Mineral Process Engineering	2	0	8
General Education subject/s		2	2	15

Total HPW Session 1 22
Total HPW Session 2 22
Total Credit Points 118

		HPW S1	HPW S2	CP
Year 4 (Process Metallurgy Major)				
APSE0002	Social Issues in Applied Science	2	0	5
MATS1214	Welding and other Joining Processes	2	0	5
MATS1244	Management 2	0	4	10
MATS1254	Design Project	1	3	10
MATS1464	Materials Seminar	1	1	5
MATS3524	Project (Metallurgical Engineering)	3	9	30
MATS4553	Non-Destructive Testing	0	1	2.5
MATS5253	Metallurgical Reaction Engineering	2	0	5
MATS5324	Modelling Metallurgical Processes	4	0	10
MATS5384	Air pollution Control in the Metallurgical Industry	1	0	2.5
Professional Electives*		4	2	15

Total HPW Session 1 20
Total HPW Session 2 20
Total Credit Points 100

**A list of Professional Electives will be made available at the end of the Year 3 program and choices for the following year arrived at.*

3130
Metallurgy - Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

This course is designed for students who are employed in the metallurgical and manufacturing industries and extends over six part-time years of study. Some of the subjects of stages 3, 4, 5 and 6 may be available only in day-time classes, and one day or more of release from industry per week may be required. The course essentially covers the same subject matter as the first three years and part of Year 4 of the full-time Metallurgical Engineering course and involves the same major strands of study in Physical Metallurgy and Metallurgical Engineering. In the later stages of the course, there is less emphasis on primary metallurgy than in the full-time course and there is more emphasis on secondary Metallurgical Engineering which is developed to Year 4 level, while Physical Metallurgy is taken to Year 3 level. Students are required to complete an approved program of industrial training of not less than twelve months prior to the award of the degree. Industrial training should normally be completed concurrently with attendance in the course, but with approval of the Head of School may be completed after completion of the prescribed course of study.

		HPW S1	HPW S2	CP
Stage 1				
MATH1131 / MATH1141	Mathematics 1A *or* Higher Mathematics 1A	6	0	15
MATH1231 / MATH1241	Mathematics 1B *or* Higher Mathematics 1B	0	6	15
PHYS1002	Physics 1	6	6	30
Total HPW Session 1	12			
Total HPW Session 2	12			
Total Credit Points	60			
Stage 2				
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	0	6	15
MATS1001	Introduction to Materials Industry	2	0	5
MATS1011	Introduction to Materials Engineering	1	0	2.5
MATS1021	Introduction to Computing	0	2	5
MECH0440	Engineering Statics	0	3	7.5
MECH0130	Engineering Drawing and Description Geometry	4	0	10
Total HPW Session 1	13			
Total HPW Session 2	11			
Total Credit Points	60			

		HPW S1	HPW S2	CP
Stage 3				
CHEM2818	Physical Chemistry	5	0	12.5
MATH2021	Mathematics	2	2	15
MATS1072	Physics of Materials	3	0	7.5
MATS1082	Thermodynamics of Materials 1	0	3	7.5
MATS1092	Materials and Design 1	0	2	5
MATS1102	Numerical Methods	1	2	7.5
General Education subject/s		0	2	7.5
Total HPW Session 1	11			
Total HPW Session 2	11			
Total Credit Points	62.5			
Stage 4				
MATS1002	Microstructural Analysis	0	3	7.5
MATS1022	Materials Process Principles	0	1	2.5
MATS1032	Materials Engineering 1A	3	0	7.5
MATS1042	Crystallography and X-ray Diffraction	4	0	10
MATS1052	Materials Engineering 1B	0	3	7.5
MATS1062	Mechanical Properties of Materials	4	0	10
MATS1112	Phase Equilibria	0	2	5
General Education subject/s		0	2	7.5
Total HPW Session 1	11			
Total HPW Session 2	11			
Total Credit Points	57.5			
Stage 5				
MATS1183	Non-Ferrous Physical Metallurgy	2	0	5
MATS1273	Ferrous Physical Metallurgy A	0	4	10
MATS2213	Diffusion	2	0	5
MATS2223	Phase Transformations	0	3	7.5
MATS4513	Deformation of Metals	2	0	5
MATS4523	Strengthening Mechanisms	0	2	5
MATS4533	Metal Forming	2	0	5
MATS4543	Fractographic Analysis	0	3	7.5
General Education subject/s		2	0	7.5
Total HPW Session 1	10			
Total HPW Session 2	12			
Total Credit Points	57.5			
Stage 6				
MATS1164	Welding Science and Technology	0	3	7.5
MATS1203	Materials and Design 2	2	2	10
MATS1464	Materials Seminar	1	1	5
MATS4144	Mechanical and Thermal Processing of Materials	0	2	5
MATS4204	Industrial Metallurgy Project	3	3	15
General Education subject/s		2	0	7.5
Total HPW Session 1	9			
Total HPW Session 2	12			
Total Credit Points	55			

Materials Engineering

A four-year full-time course in materials engineering leading to the award of the BMatE degree is offered within the School.

3615
Materials Engineering - Full-time Course

Bachelor of Materials Engineering
BMatE

		HPW S1	HPW S2	CP
Year 1				
CHEM1101	Chemistry 1A	6	0	15
CHEM1201	Chemistry 1B	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
MATS1001	Introduction to the Materials Industry	2	0	5
MATS1011	Introduction to Materials Engineering	1	0	2.5
MATS1021	Introduction to Computing	0	2	5
MECH0130	Engineering Drawing and Descriptive Geometry	4	0	10
MECH0440	Engineering Statics	0	3	7.5
PHYS1002	Physics 1	6	6	30
Total HPW Session 1		**25**		
Total HPW Session 2		**23**		
Total Credit Points		**120**		

Year 2				
CHEM2818	Physical Chemistry	5	0	12.5
MATH2021	Mathematics	2	2	15
MATS1022	Materials Process Principles	0	1	2.5
MATS1002	Microstructural Analysis	0	3	7.5
MATS1032	Materials Engineering 1A	3	0	7.5
MATS1042	Crystallography and X-ray Diffraction		4	10
MATS1052	Materials Engineering 1B	0	3	7.5
MATS1062	Mechanical Properties of Materials	4	0	10
MATS1072	Physics of Materials	3	0	7.5
MATS1082	Thermodynamics of Materials 1	0	3	7.5
MATS1092	Materials and Design 1	0	2	5
MATS1102	Numerical Methods	1	2	7.5
MATS1112	Phase Equilibria	0	2	5
General Education subject/s		0	4	15
Total HPW Session 1		**22**		
Total HPW Session 2		**22**		
Total Credit Points		**120**		

Year 3				
MATH2869	Statistics SC	2	0	5
MATS1093	Thermodynamics of Materials 2	2	0	5
MATS1113	Ceramic Process Principles 1	2	0	5
MATS1163	Chemistry of the Solid State	2	0	5
MATS1203	Materials and Design 2 (Unit 1 Design for Corrosion Control)	2	0	5
	(Unit 2 Surface Treatment and Wear)	0	2	5
MATS1243	Management 1	3	0	7.5
MATS1283	Ferrous Physical Metallurgy B	0	3	7.5
MATS2213	Diffusion	2	0	5
MATS2223	Phase Transformations	0	3	7.5
MATS3443	Polymer Science and Engineering	0	6	15
MATS4333	Fracture Mechanics	2	0	5
MATS4513	Dislocations	2	0	5
MATS4523	Deformation and Strengthening Mechanisms	0	2	5
MINE7341	Mineral Process Engineering	2	0	8
General Education subject/s		0	4	15
Total HPW Session 1		**21**		
Total HPW Session 2		**20**		
Total Credit Points		**110.5**		

Year 4				
APSE0002	Social Issues in Applied Science	2	0	5
MATS1183	Non-Ferrous Physical Metallurgy	2	0	5
MATS1214	Welding and other Joining Processes	2	0	5
MATS1244	Management 2	0	4	10
MATS1254	Design Project	1	3	10
MATS1464	Materials Seminar	1	1	5
MATS3524	Project (Materials Engineering)	3	9	30
MATS3544	Polymer Engineering	5	0	12.5
MATS4590	Solidification and Casting	0	1	2.5
Professional Electives*		3	3	15
Total HPW Session 1		**19**		
Total HPW Session 2		**21**		
Total Credit Points		**100**		

**A list of Professional Electives will be made available at the end of the Year 3 program and choices for the following year arrived at.*

Graduate Study

Course Outlines

The School welcomes enquiries from graduates in Science, Engineering and Applied Science who are interested in doing research leading to the award of the degrees of Master of Science, Materials Science and Engineering **2055**, Mineral Processing and Extractive Metallurgy **2046** or Doctor of Philosophy, Materials Science and Engineering **1045**, Mineral Processing and Extractive Metallurgy **1046**, and Master of Engineering in Materials Science and Engineering **2175**. Programs involving formal course work and research leading to the award of Master of Applied Science in Engineering Materials **8065** or Master of Applied Science in Corrosion Engineering **8052** are also available.

Information about research scholarships, fellowships and grants in-aid is available from the Postgraduate Coordinator and graduates are advised to consult him before making a formal application for registration.

8065
Engineering Materials

Master of Applied Science
MAppSc

The MAppSc course in Engineering Materials provides a comprehensive study of the full range of materials. The program is designed for graduates wishing to acquire expertise in the selection, use and design capabilities of modern materials. It is particularly appropriate to graduates in other branches of engineering, and to honours graduates in science.

The program consists of one year's full-time study. This is made up of a formal time allocation of 18 hours per week, and will normally be supplemented by additional project work during the summer break. The balance between formal lecture courses and project work will be varied to suit individual student's needs.

Compulsory Subjects

		HPW S1	HPW S2	CP
MATS6475	Materials Science and Engineering	3	3	15
MATS6485	Materials Technology	3	3	15
MATS6405	Graduate Materials Seminar	2	2	10
Project				
MATS6555	Minor Graduate Materials Project	3	3	15
or				
MATS6565	Major Graduate Materials Project	9	9	45

Elective Subjects

Additional subjects are chosen from those offered by the School of Materials Science and Engineering, or from those offered by other Schools in the University subject to approval by the Head of School. Full details of all subjects are listed in the University calendar and handbooks. A minimum of two hours per week for one session of elective subjects is required.

Depending on the candidate's background, enrolment in a limited number of unmodified undergraduate subjects may be appropriate, but may not exceed 15% of the non-project component. In all cases, the total of the compulsory core, project and elective subjects will be a minimum of 18 hours per week.

8052
Corrosion Engineering

Master of Applied Science
MAppSc (Corr Eng)

The Master of Applied Science Course in Corrosion Engineering is open to graduates in Engineering, Applied Science or Science who wish to undertake formal studies to promote their careers in industry. The course is designed for those professionals in industry who are faced with the problem of combating corrosion. Its aim is to develop an appreciation of the fundamentals, principles of corrosion and of the available methods whereby it may be overcome.

The program consists of one year's full-time study (2 sessions) or two years' part-time study (4 Sessions). This is made up of a formal time allocation of 18 hours per week and will normally be supplemented by additional project work during the summer break. The balance between formal lecture courses and project work will be varied to suit individual student's needs.

		HPW S1	HPW S2	CP
MATS1092	Materials and Design 1	0	2	5
MATS6005	Corrosion Project	6	6	30
MATS6203	Design for Corrosion Control	0	2	5
MATS6475	Materials Science and Engineering	3	3	15
MATS6495	Corrosion Materials	4	2	15
MATS6535	Industrial Coatings for Corrosion Protection	2	0	5
MATS6545	Corrosion Technology	3	3	15

**UNSW graduates who have done MATS9542 (4.952, 5.4222), CIVL2402 (8.240),MATS9530 (4.913), and/or CIVL4403 (8.440) must substitute other appropriate subjects approved by the postgraduate coordinator in the School of Materials Science and Engineering.*

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: A/Prof CC Sorrell
CP5 S1 L/T2

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.

MATS1001
Introduction to the Materials Industry
Staff Contact: A/Prof CC Sorrell
CP5 S1 L1 T1

The role of materials science and engineering in industry. Engineering materials. Information retrieval. Communication skills. Plant visits. Introductory materials science. Structure and properties of main types of engineering materials with emphasis on the ways in which properties may be controlled by controlling structure.

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.

MATS1011
Introduction to Materials Engineering
Staff Contact: Dr A G Crosky
CP2.5 S1 L1

Metals, ceramics, polymers and composites, their structure, chemical, physical and mechanical properties, engineering applications and production with particular reference to Australian industries.

MATS1021
Introduction to Computing
Staff Contact: Dr A K Hellier
CP5 S2 L2

Introductory computing. Outline of computer architecture. Features of common computing languages; syntax, structure, variable typing, portability. Basic syntax. Common numerical techniques, function evaluation, Monte Carlo techniques; assignments involving application of these techniques. Word processing, spreadsheets and databases.

MATS1022
Materials Process Principles
Staff Contact: Dr P Wong
CP2.5 S2 L0.5 T0.5

Introduction to engineering calculations. Material balances. Techniques for solving problems, including selection of a basis for calculations, use of tie elements and recycle calculations. General energy balances. Unsteady-state material and energy balances. Examples are drawn from ceramic, materials and metallurgical engineering practices.

MATS1032
Materials Engineering 1A
Staff Contact: Dr V Sahajwalla
CP7.5 S1 L2 T1

Fluid flow in materials processing. Application of the principles of fluid flow in the production and application of ceramic and metallic materials. Subject examples are drawn from ceramic, materials and metallurgical engineering practice in the broadest sense.

MATS1042
Crystallography and X-Ray Diffraction
Staff Contact: Dr A Hellier
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.

MATS1043
Heat, Fluid and Mass Flow in Materials Processing
Staff Contact: Dr V Sahajwalla
CP5 S1 L2

In-depth understanding of fundamental principles dictating transport phenomena in materials processing. Development of governing equations related to the transfer of fluid, energy and mass and their inter-dependence based upon fundamentals to analyse and solve problems encountered in current metallurgical operating environments. Application of the understanding developed to the emerging new technologies for metals processing such as direct reduction and smelting for iron-making, near net shape casting.

MATS1052
Materials Engineering 1B
Staff Contact: Dr P Wong
CP7.5 S2 L1 T2

Heat applications of principles of steady and unsteady heat transfer in the production and application of materials. Course examples are drawn from materials engineering practice in the broadest sense. Heat flow in materials processing involving high temperature solid, liquid and gaseous phases. Thermal properties of dense and porous materials. Heat treatment, casting, sintering, corrosion, etc. Computer programs for calculating heat flow in materials.

MATS1062
Mechanical Properties of Materials
Staff Contact: Dr P Krauklis
CP10 S1 L2 T2
Prerequisite: MECH0130

Mechanical properties of solids. Nature and significance of mechanical properties. Mechanical testing; the tension test, hardness testing and impact testing. Stress-strain-time relationships. Analysis of stress and strain, stress and strain transformation relationships, Mohr's circle, elastic stress-strain relationships, application to various types of loading and metal working processes. Failure and yielding criteria. Influence of stress state, temperature, strain rate and environment on mechanical behaviour.

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.

MATS1082
Thermodynamics of Materials 1
Staff Contact: Dr P Wong
CP7.5 S2 L2 T1

Fundamental principles of the thermodynamics of closed and open systems. Phase equilibria, the stability and composition of coexisting phases. Chemical potential, fugacities and activities of gases and gas mixtures. The thermodynamics of nucleation and growth of precipitates and spinodal decomposition. Order-disorder in phases. Tabular, analytical and diagrammatic representation of thermodynamic properties. Mass and energy balances. Application of thermodynamics to materials properties and preparation.

models, properties.

MATS1092
Materials and Design 1
Staff Contact: Dr AG Crosky
CP5 S2 L1 T1

An appreciation of the relationships between the properties of materials, component design, manufacturing and product performance. Materials selection as an integral part of successful design. Long-term potential for materials improvement and substitution. Plant visits to selected materials processing plants.

MATS1093
Thermodynamics of Materials 2
Staff Contact: Dr O Ostrovski
CP5 S1 L2
Prerequisite: MATS1082

Thermodynamics of solutions. Partial and integral thermodynamic functions, excess functions. Thermodynamic activity and activity coefficient. Standard states for solute components. Models of solutions. Thermodynamic stability. Calculation of phase diagrams. Perfect and regular ionic solutions. Thermodynamics of polymer solutions. Calculation of chemical equilibria in complex systems.

MATS1102
Numerical Methods
Staff Contact: Dr A K Hellier
CP7.5 F L1 T5
Prerequisite: MATS1021

Finite difference and finite element techniques and their application to materials phenomena involving heat transfer, elasticity and plasticity.

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.

MATS1113
Ceramic Process Principles 1
Staff Contact: Mr S Prokopovich
CP5 S1 L2

The nature of ceramics. The scope of the ceramic industry, and principal unit operations. Particle packing: two, three and multi-component systems. Principal unit operations used in the ceramic industry. Drying and firing of ceramics. Glass and other melt forming processes. Hot forming and miscellaneous forming methods.

MATS1163
Chemistry of the Solid State
Staff Contact: A/Prof CC Sorrell
CP5 S1 L2

Crystal chemistry; nature of bonding in solids, ionic, and silicate structures; and structure-composition relationships. Glass and glass-ceramics. Reaction with solids, grain boundary and interfacial effects, ceramic reactions and polymorphic transformations (oxides, non-oxides, alumino-silicates).

MATS1164
Welding Science and Technology
CP7.5
Unit 1 Welding Technology
Staff Contact: Dr AG Crosky
S1 or S2 L1

Fusion welding and allied processed. Capabilities, advantages and limitations.

Unit 2 Welding Metallurgy
Staff Contact: Dr AG Crosky
S1 or S2 L1 T1

Metallurgical aspects of fusion welding and allied processes. Cause of welding defects and weldability of carbon and alloy steels, stainless steels, aluminium and other common nonferrous alloys. Assessment of welds by mechanical testing and non-destructive methods.

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.

MATS1203
Materials and Design 2
CP7.5
Unit 1 Design for Corrosion Control
Staff Contact: Prof DJ Young
S1 L1 T1

Electrochemical corrosion, types of corrosion, influence of alloying and heat treatment, influence of stress. Corrosion prevention, cathodic protection, passivation and inhibitors, selection of materials, designing against corrosion.

Unit 2 Surface Treatment and Wear
Staff Contact: Dr P Krauklis
S2 L1 T1

Coatings for corrosion prevention, engineering and decorative purposes. Adhesion. Surface modification. Specifications for coating systems. Selection testing and evaluation of coating. Classification of wear modes. Mechanisms of adhesive and abrasive wear. Selection, testing and evaluation of materials for wear mitigation. Wear-resistance materials.

MATS1214
Welding and other Joining Processes
Staff Contact: Dr A Crosky
CP5 S1 L1T1

Fusion welding. Capabilities, advantages and limitations. Metallurgical aspects of fusion welding. Cause of welding defects and weldability of carbon and alloy steels, stainless steels, aluminium and other common non-ferrous alloys. Design of welded fabrications to reduce distortion and the risk of failure by fatigue, brittle fracture, etc. Soldering, brazing, adhesive bonding.

MATS1224
Materials Characterisation
Staff Contact: Dr B Gleeson
CP2.5 S1 L5 T5

Materials characterisation by advanced techniques including secondary ion mass spectroscopy (SIMS), auger electron spectroscopy (AES), X-ray photoelectron spectroscopy (XPS) and laser Raman spectroscopy.

MATS1234
Heat Resisting Alloys
Staff Contact: Prof D Young
CP2.5 S1 L1

Microstructure and properties of high temperature alloys, iron-base alloys, nickel-iron alloys, nickel-base alloys and chromium-base alloys, Strengthening mechanisms. Creep, oxidation and hot corrosion. Coatings and protection. Process metallurgy and applications of high temperature alloys.

MATS1243
Management 1
Staff Contact: Dr P Wong
CP7.5 S1 L3

Micro-economic principles. Supply and demand analysis. Comparison of benefits and costs. Macro-economic principles. Fiscal policy.Investment and monetary policy. Inflation and unemployment. Basic accounting concepts. Interpreting financial statements. Management accounting.

The legal environment of business. Contracts. Products and services liability. Industrial relations. Industrial conflict. Wage determination.

Operations management: systems, strategies and benefits. Quality assurance, and quality management systems. The elements of total quality management, TQM.

MATS1244
Management 2
Staff Contact: Dr P Krauklis
CP10 S1 or S2 L4

The major issues, research findings and management strategies relating to the human side of enterprise. Topics include management and power, leadership and innovation, managerial decision-making, stress at work, group dynamics and inter-group conflict, organisational design, goal setting and performance appraisal, approaches to personal and organisational development. Marketing and sales; marketing research, marketing strategies, customer relations, total product package. Project management: project planning and scheduling, contract planning and control, recent developments.

MATS1254
Design Project
Staff Contact: Dr A Crosky
CP10 S1 T1 S2 T3

This project will cover the design of a selected piece of processing equipment or an engineering component. It will involve selection and specification of materials and other relevant aspects covered within the undergraduate course.

MATS1264
Fibre Reinforc ed Plastic Composites
Staff Contact: Dr A Crosky
CP2.5 S1 L1

Philosophy of a composite. Fibre and matrix materials. Design with composites. Fabrication techniques. Properties of composites. Applications..

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.

MATS1274
Metal and Ceramic Matrix Composites
Staff Contact: Dr S Bandyopadhyay
CP2.5 S2 L1

Metal and ceramic matrix composites - their advantage and scope; various systems of MMCs and CMCs. Role of interface; fabrication techniques; effect of volume fraction; size and size distribution. Strengthening and toughening mechanisms.

MATS1283
Ferrous Physical Metallurgy B
Staff Contact: Dr P Krauklis
CP7.5 S2 L2 T1

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.

MATS1284
Light Alloys
Staff Contact: Dr P Munroe
CP2.5 S2 L1

Production and processing of titanium alloys. Titanium alloy development. Properties of titanium alloys. Advanced aluminium alloys, rapid solidification of titanium and aluminium alloys. Powder processing of titanium and aluminium alloys. Advanced magnesium alloys.

MATS1294
Electrical Ceramics
Staff Contact: School Office
CP5 S1 L1 T1

Defect structure of ionic solids. Ionic conduction: zirconia solid electrolytes, beta-alumina rapid ion conductors, humidity sensors. Electronic conduction: semiconductors, varistors, thermally-sensitive resistors, superconductivity. Ceramic insulators and dielectrics. Piezoelectric, pyroelectric, and electro-optic ceramics. Magnetic ceramics.

MATS1464
Materials Seminar
Staff Contact: A/Prof CC Sorrell
CP5 F T1

Demonstration of public speaking skills and techniques. Preparation of visual aids. Library usage. Preparation and standards of written material. Chairpersonship. Each student is required to make two oral presentations based on the honours project.

MATS1534
Design with Brittle Materials
Staff Contact: Mr SA Prokopovich
CP7.5 S1 L2 T1

General design considerations. Nature and properties of ceramic materials. Effects of composition and microstructure on physical properties of ceramics. Mechanical properties of ceramics: brittleness, hardness and wear resistance, high-temperature capability, static fatigue. Manufacture of ceramic materials. Design approaches of ceramics: empirical, deterministic, probabilistic and linear elastic fracture mechanics. Design of components and selection of materials. Inspection and non-destructive testing.

MATS2123
Ceramic Process Principles 2
Staff Contact: Mr SA Prokopovich
CP5 S2 L2

Plasticity in a clay-water system. Linear drying shrinkage. Air-water vapour system, psychrometry and drying calculations. Effect of porosity on ceramics. Calculations involving ceramic suspensions. Glass, glaze and porcelain enamel calculations. Relationship between the composition and physical properties of glasses. Rational analysis of clay and fluxing materials. Body formulation. Flue gas analysis and combustion calculations. ceramic laboratory instrumentation. Safety aspects in ceramics.

MATS2133
Ceramic Raw Materials
Staff Contact: Mr SA Prokopovich
CP5 S1 L2

The geological origin of ceramic raw materials. The minerals, mineralogical composition, properties and uses of commercial clays. The sources, physical properties and uses of non-clay raw materials.

MATS2143
Ceramic Equipment
Staff Contact: Mr SA Prokopovich
CP5 S2 L2

The principles of operation, construction and fields of application of equipment used in the ceramic industry in the following areas.Preparation of raw materials and auxiliary processing operations; forming, drying and firing of ceramic products.

MATS2153
Ceramic Processing Laboratory
Staff Contact: Mr SA Prokopovich
CP10 S2 T4

Laboratory progam illustrating processing and engineering aspects of ceramic technology. Students are required to take part in a series of factory inspections.

MATS2183
Refractories
Staff Contact: A/Prof CC Sorrell
CP5 S2 L2

Classification of refractories. Chemical and physical properties of refractories. Introduction to raw materials and manufacturing technology. A detailed study of chemical reactions occurring between refractories and solid, liquid and gas phases in ferrous and nonferrous metal industry. Review of phase equilibria.

MATS2203
Physico Chemical Ceramics Laboratory
Staff Contact: A/Prof CC Sorrell
CP10 S1 T4

Laboratory progam illustrating the physical and chemical properties associated with the processing and performance of ceramic materials. Students are required to take part in a series of factory inspections.

MATS2213
Diffusion
Staff Contact: Dr AK Hellier
CP5 S1 L1 T1

Fick's first and second laws. Solutions for short and long times by analytical and numerical methods. Boundary conditions for solid-fluid and solid-solid interfaces. Diffusion couples. Atomic level diffusion theory

MATS2223
Phase Transformations
Staff Contact: Dr B Gleeson
CP7.5 S2 L2 T1

Solidification: single phase, eutectic and neareutectic, peritectic. Diffusional transformation: percipitation, ripening, cooperative transformations, TTT and CCT curves. Diffusionless transformations: crystallography, nucleation and growth modes.

MATS2254
Ceramic Engineering Design
Staff Contact: Mr SA Prokopovich
CP5 S2 L2

Engineering aspects of ceramic processing. Ceramic engineering design including design of dryers, kilns and glass tanks. Case studies. Pollution control equipment.

MATS2264
Sintering of Ceramics
Staff Contact: A/Prof CC Sorrell
CP5 S1 L1.5 T5

Defects and phase transitions. Recrystallisation, grain growth, and nucleation. Stages of sintering. Transport mechanisms, different modes of sintering (vapour, liquid, reactive liquid, solid), additives, and hot pressing. Secondary phenomena (oxidation, decomposition, phase transformations, trapped gases, non-uniform mixing, overfiring), time-temperature effects, firing shrinkage, and warpage.

MATS2273
Chemistry of Ceramic Processes
Staff Contact: A/Prof CC Sorrell
CP5 S2 L2

High-temperature reactions involving clays, silicates, oxides, and nonoxides. Processing effects of calcining, chemical reaction and vitreous and crystalline bond formation. Chemical and physical aspects of production of whitewares, porcelain, heavy clay products, glass, cements, cermets, and advanced high-purity ceramics.

MATS2284
Thermal Properties of Ceramics
Staff Contact: A/Prof CC Sorrell
CP5 S2 L2

Heat capacity, measurement of heat capacity and factors affecting heat capacity. Thermal expansion, measurement of thermal expansion and factors affecting thermal expansion. Thermal conductivity, thermal diffusivity, measurement of thermal conductivity and thermal diffusivity, factors affecting thermal transport, phonon and photon conductivity and factors affecting phonon and photon conductivity. Thermal stresses and thermal shock. Influence of structure and composition of pure materials on thermal conductivity of multiphase ceramics.

MATS2304
Project (Ceramic Engineering)
Staff Contact: School Office
CP30 S1 T3 S2 T9

An experimental or technical investigation or design related to some aspects of ceramic engineering.

MATS3443
Polymer Science and Engineering
Staff Contact: Dr S Bandyopadhyay
CP15 S2 L4 T2

Polymer structure. Mers, bond strength, functionality. Addition and condensation polymerization. Chain branching, cross linking, crystallinity. Thermosets and thermoplastics. Copolymers, blending, plasticisers. Polymer orientation. Polymer tailoring. Melt, glass and lower transitions. Effect of chemical molecular structure on performance. Elastomers, fibres, foams, composites. Elementary polymer identification. Common families of commodity plastics, engineering plastics and elastomers.

MATS3524
Project
Staff Contact: Dr B Gleeson
CP30 S1 T3 S2 T9

An experimental or technical investigation or design related to some aspects of materials engineering in the specific discipline (ceramic engineering, metallurgical engineering or materials engineering).

MATS3544
Polymer Engineering
Staff Contact: Dr S Bandyopadhyay
CP15 S1 L3.5 T1.5

Mechanical behaviour of polymers. Critical effects of temperature variation on behaviour of thermoplastics under load. Comparison with thermosets. Factors contributing to strength and toughness. Viscoelasticity. Yielding, deformation and fracture. Elastomer performance. Effect of strain rate. Crazing. Effect of environment. Strategies to reduce stress and increase toughness. Creep, recovery and stress relaxation. Time-temperature superposition. Fatigue. Selection of commodity plastics, engineering plastics and elastomers for particular applications. Degradation. Processing of polymers.

MATS4154
Mechanical and Thermal Processing of Metals
Staff Contact: Dr AG Crosky
CP2.5 S1 L1

Mechanisms of deformation. Annealing. Development of deformation and annealing textures. Superplasticity..

MATS4204
Industrial Metallurgy Project
Staff Contact: School Office
CP15 F3

An experimental investigation of some aspect of industrial metallurgy.

MATS4333
Fracture Mechanics
Staff Contact: Dr A Hellier
CP5 S1 L1 T1

Linear elastic fracture mechanics: modes of loading, stress intensity factor concept, effect of finite boundaries, energy

release rate concept. Fracture toughness testing and evaluation; ASTM E399 and alternative specimen types. Subcritical fracture mechanics; fatigue, stress corrosion cracking. Elastic-plastic fracture mechanics; crack opening displacement, J-integral.

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, activiation energy of strain ageing.

MATS4533
Metal Forming Processes
Staff Contact: Dr AG Crosky
CP5 S1 L2

Metal forming. Introduction to metal forming operation. Factors affecting deformation and workability. Hot working, cold working and recrystallisation. Processes: forging, rolling, extrusion and wire drawing. Die materials and geometry. Deformation parameters and processing defects. Plant visits.

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.

MATS4553
Non-Destructive Testing
Staff Contact: Dr AG Crosky
CP2.5 S2 L1

Concepts of quality assurance and quality control. Techniques of liquid penetrant, magnetic particle ultrasonic and radiographic inspection. Systems and processes, inspection and evaluation.

MATS4580
Electrometallurgy of Steel and Ferroalloys
Staff Contact: Dr O Ostrovski
CP2.5 S2 L1

Electric arc furnace (EAF) steelmaking. Energy, raw materials and consumables. Basic principles of EAF. Technology of EAF steelmaking. Modern EAF steelworks. Induction furnaces. Secondary steelmaking. Remelting processes. Basic principles of EAF ferroalloymaking. Technology of silicon, manganese and chromium alloys production.

MATS4590
Solidification and Casting
Staff Contact: Dr V Sahaywalla
CP2.5 S2 L1

Understanding the fundamentals of solidification (cast structure development, high temperature properties) in casting processes. Emphasis on conventional and emerging near net shape casting processes. Application of the solidification fundamentals to understand mechanisms of various quality problems encountered in these processes. Process optimisation (machine design, chemistry, temperature, heat extraction) to control casting defects).

MATS5213
Metallurgical Plant Practice
Staff Contact: Dr O Ostrovski
CP2.5 S1 or S2 T1

Up to 2 days of metallurgical plant inspections and case studies equivalent to14 tutorial hours are associated with this subject. Ferrous and non-ferrous plant practice.

MATS5253
Metallurgical Reaction Engineering
Staff Contact: Dr O Ostrovski
CP5 S1 or S2 L2

Metallurgical reactor design: batch and continuous reactors. Gas-solid reactions. Limiting laws for gas-liquid reactions in steelmaking processes. Liquid-liquid reactions, design of extractive and refining operations.

MATS5263
Extractive Metallurgy
Staff Contact: Dr O Ostrovski
CP17.5 S1 L3 S2 L2 T2

A review of the unit of operations in extractive metallurgy: roasting, sintering, smelting and refining. Iron blast furnace. Alternative ironmaking, direct reduction and smelting. Oxygen steelmaking. Electric arc furnace. Ladle metallurgy. Copper, lead and zinc smelting. Aluminium production.

Application of principles of aqueous thermodynamics, electrochemistry, chemical and electrochemical kinetics to hydrometallurgical processes: leaching of mineral and concentrates, solution purification, precipitation, and other separation processes, ion-exchange and liquid-liquid extraction, electrowinning and electrorefining.

MATS5314
Kinetics and Mass Transfer in Metallurgical Processes
Staff Contact: Dr A Yu
CP10 S1 L1 S2 L2 T1

Kinetics and mass transfer in metallurgical processes. Kinetics of interphase transfer in metallurgical systems. Single particle, fluid/solid reactions, topochemical reactions, reactions of porous solids. Application to reduction of iron oxides. Reaction between liquid metals and gases, reactions involving drops and bubbles. Reaction between liquid metals and slags, mass transfer at bubble stirred interfaces. Application to metal refining process. Vacuum degassing and refining processes.

MATS5324
Modelling Metallurgical Processes
Staff Contact: Dr P Wong
CP10 S2 L4

The mathematical and physical modelling of primary and secondary metals processing operations. Ladle metallurgy operations, entrainment of gases by molten metals, electromagnetically driven flows, dispersion of alloying additions, coalescance of inclusions, modelling metal flow and solidification, blast furnace drainage.

MATS5384
Air Pollution Control in the Metallurgical Industry
Staff Contact: Dr V Sahajwalla
CP2.5 S1 or S2 L1

Air pollutants from the different metallurgical industries. Technical principles and equipment to control the emission of pollutants. Examples from the primary and secondary metallurgical industries.

MATS6005
Corrosion Project
Staff Contact: School Office
CP30 F HPW6

A substantial project on some aspect of corrosion science or technology.

MATS6203
Materials and Design 2
Unit 1 Design for Corrosion Control (Unit 1 of MATS1203)
Staff Contact: Prof DJ Young
CP5 S1 L1 T1

Electrochemical corrosion, types of corrosion, influence of alloying and heat treatment, influence of stress. Corrosion prevention, cathodic protection, passivation and inhibitors, selection of materials, designing against corrosion.

MATS6405
Graduate Materials Seminar
Staff Contact: School Office
CP10 F HPW2

Instruction in written and oral presentation of technical and scientific material at an advanced level which involves a presentation by the candidate of a lecture on a selected topic.

MATS6475
Materials Science and Engineering
Staff Contact: School Office
CP15 F L2 T1

The characteristics of crystalline solids. Defect structure of crystals and influence of defects on their mechanical behaviour. Micromechanism of elastic and plastic deformation. Microstructure and structure-property relationships of the main types of engineering materials (Metals, Ceramics, Polymers and Composites). Phase Equilibria of alloys; microstructural control by thermomechanical processing and application to commercial engineering materials. Fracture mechanisms for ductile, brittle, creep and fatigue modes of failure in service. Metallic corrosion and degradation of other classes of materials. Polymer materials: The structure and properties of polymers. Mechanisms for the modification of properties. Ceramic materials: The structure and properties of ceramics. Composite materials. Design and development of materials for specific engineering applications. Appropriate laboratory and tutorial work.

MATS6485
Materials Technology
Staff Contact: School Office
CP15 F L1.5 T1.5

Material properties and their effect on component design, manufacturing and product performance. Materials selection as an integral part of successful design. Long-term potential for materials improvement and substitution. Plant visits to successful materials processing plants. Atomic and microstructure determination: X-ray production, absorption and diffraction using powder and single crystal methods. Stereographic projections and crystal geometry. Application of diffraction methods to solid solutions and solubility limit, thermal analysis, stress measurement, and chemical stream analysis. Electron optics and analysis. Transmission and scanning electron microscopy. Energy-loss spectrometers. Microanalysis.

MATS6495
Corrosion Materials
Staff Contact: School Office
CP15 F L2 T1

Properties and efficient selection of materials for corrosion resistance. Applications in manufacturing, mining and process industries, in transportation equipment and in structures. Materials selection for service in particular environments.

MATS6535
Industrial Coatings for Corrosion Protection
Staff Contact: School Office
CP5 S1 L2

Special topics on heavy-duty organic, inorganic and metallic coatings used in atmospheric, marine and industrial environments.

MATS6545
Corrosion Technology
Staff Contact: School Office
CP15 F L3

Environmental fracture; corrosion in specific environments; corrosion of specific equipment types; principles of materials selection and design; surface preparation and maintenance coatings; polymeric materials and linings, inhibitors and electrochemical tests methods; cathodic protection.

MATS6555
Minor Graduate Materials Project
Staff Contact: School Office
CP15 F HPW3

A small technical investigation or a design project, including a written report.

MATS6565
Major Graduate Materials Project
Staff Contact: School Office
CP45 F HPW9

A substantial experimental or theoretical investigation, or design project, including a written thesis.

MATS7132
Structure and Properties of Metallurgical Phases Unit 2 only.
Staff Contact: Dr O Ostrovski
CP2.5 S1 or S2 L1

The atomistic and microsopic approach to melts in process metallurgy, liquid metals,mattes, molten salts and slags. Relationships between melt structure, mechanism and reaction kinetics in smelting and refining operations.

MATS7134
Structure and Properties of Metallurgical Phases Unit 1 Structure and Properties of Solids
Staff Contact: School Office
CP7.5 S1 or S2 L1 T1

Application of defect solid state chemistry to materials preparation and reactivity. Non-stoichiometric and stoichiometric-dependent physical and chemical properties of metal compounds.

Unit 2 Structure and Properties of Melts
Staff Contact: Dr O Ostrovski
S1 or S2 L1

The atomistic and microscopic approach to melts in process metallurgy, liquid metals, mattes, molten salts and slags. Relationships between melt structure, mechanism and reaction kinetics in smelting and refining operations.

MATS7144
Powder Metallurgy
Staff Contact: School Office
CP5S1 or S2 L1

Mechanisms of sintering in metals. Techniques of powder metallurgy, compaction, powder characteristics. Sintering in the presence of liquid phase, cementation, cermets. Preparation of super-alloys.

MATS7244
Advanced Electron Optics
Staff Contact: School Office
CP5 S1 or S2 L1 T1

See School for details.

MATS7470
Polymer Processing and Fabrication
Staff Contact: Dr S Bandyopadhyay
CP10 S1 L2 T2

Factors affecting quality and efficiency of extrusion, injection moulding and other fabrication techniques. Polymer viscous flow; viscometry; fluid flow and heat transfer in melt processing. Effect of polymer chemical structure, temperature and molecular weight upon flow properties. Computer simulation of polymer flow during processing.

MATS7480
Polymer Product Design
Staff Contact: Dr S Bandyopadhyay
CP5 S2 L2

Designing with polymeric materials. Selection and compounding of rubbers. Rubber modification of plastics. Polymer blending, mixing and recycling. Design of plastic and rubber components. Plant visits.

MATS7490
High Temperature Techniques
Staff Contact: School Office
CP2.5 S1 or S2 L1

Experimental methods for the determination of thermophysical and thermochemical properties at elevated temperatures.

MATS7500
Mathematical Plasticity
Staff Contact: Dr AK Hellier
CP2.5 S1 or S2 L1

Mathematical approaches to macroscopic plastic deformation; slip line field analysis, upper and lower bound techniques, finite element techniques. Application to estimation of loads and stresses developed during industrial deformation processes: rolling, drawing, bending.

MATS9421
Materials for Mining Engineers
Staff Contact: Dr P Krauklis
CP10 S1 L2 T1 S2 L1

Session 1: Microstructure, phase equilibrium and properties of steels, light alloys, ceramics, polymer and composites. Metal forming by casting and mechanical working. Elastic and plastic deformation, recrystallisation, fracture, corrosion.

Session 2: Characterisation of materials by mechanical testing. Abrasive wear: gouging, high stress and low stress abrasion. Mitigation of abrasion. Abrasion resistant materials.

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.

MATS9640
Materials Science and Engineering for Electrical Engineers
Staff Contact: School Office
CP10 S2 L3 T1

Metallic, ceramic, organic, polymeric and composite materials and their technology for electrical engineering applications. Structures and structure property relations, phase equilibria and their effect on mechanical, electrical, magnetic, thermal and chemical properties. The shaping, treating and joining of materials. Aqueous and gaseous corrosion. Metallic glasses, superconductors, fast ion conductors. The role of materials science in the development of electrical energy systems.

MATS9650
Pyrometallurgical Processes
Staff Contact: Dr O Ostrovski
CP5 S1 L2

Principles and development of pyrometallurgical processes and a review of the unit operations, roasting, sintering, smelting and refining for the treatment of ferrous and non-ferrous minerals.

MATS9712
Materials and Techniques in Design Craft 1
Staff Contact: A/Prof CC Sorrell
CP10 S1 L2 T1

An introduction to the science and technology of materials, emphasizing relationships between structure, composition and properties. Introduction to processing of metallic, ceramic and fibrous materials. Materials recognition and design possibilities are discussed.

MATS9722
Materials and Techniques in Design Craft 2B
Staff Contact: A/Prof CC Sorrell
CP7.5 S2 L1.5 T1.5

Casting, working and surface finishing of metals and alloys. Soldering, brazing and welding. Joining metals to glasses, ceramics and gemstones.

MATS9732
Materials and Techniques in Design Craft 2C
Staff Contact: A/Prof CC Sorrell
CP7.5 S2 L1.5 T1.5

Structures and properties of clays, non-clays, cements, porcelains, glazes, glasses and other ceramics. optical properties and colours of glasses, glazes and gemstones. Forming and firing of ceramic bodies, reactions during firing. Kilns and oxidation/reduction effects.

School of Mines

Head of School
Associate Professor GR Taylor

Administrative Officer
Ms R Benninghaus

The School of Mines, which was formed in 1986, consists of two Departments and three Centres corresponding to the main professions on which the mining and minerals industry of Australia depend. These are the Departments of Applied Geology and Mining Engineering, and the Centre for Minerals Engineering (in conjunction with the School of Chemical Engineering), the UNSW Groundwater Centre (in conjunction wih the School of Civil Engineering), and the Key Centre for Mines.

Prior to the formation of the School of Mines, Applied Geology and Mining Engineering were separate Schools and Mineral Processing and Extractive Metallurgy (referred to as Minerals Engineering) was spread among several other Schools in the Faculty. Bringing the three together into the School of Mines is an important development in mining industry education in Australia.

Geologists, Mining Engineers and Minerals Engineers work closely together in the mining industry. The Geologist is responsible for discovering new mineral resources and for defining the size, value and condition of the deposit. Geologists are also involved in control of ore grades during the mining operation and in environmental management during and after mining. The Mining Engineer decides on the mining method, assesses the financial viability of the project, designs the mine and thereafter manages it throughout its life. The Minerals Engineer deals with these resources after they have been mined, and designs and manages the large plants needed to turn the crude ore into metal or the raw coal into saleable fuel. Groundwater geologists are employed in many fields including mining, civil engineering, water resources management and environmental management.

Each is an expert in her or his own field, but each also needs to have a good appreciation of the work of the others. Professional roles in the mining industry are not always clear cut and it is a distinct advantage for geologists, mining engineers and minerals engineers to study and interact together while at University, in preparation for their necessarily close involvement with each other during their professional careers.

Separate degree courses are available in each discipline, as described below. Students enrol in the course of their own choice and many activities are departmentally centred, but others are School-based to provide a corporate identity with the mining and allied industries.

Department of Applied Geology

Head of Department
Associate Professor CR Ward

Geology is 'the science of the earth', and as such covers a broad spectrum of knowledge on the constitution and evolution of our planet. Applied Geology involves a specific interest in the use of earth science for the benefit of humanity, including, for example, the search for and evaluation of metallic ore-bodies and accumulations of fossil fuels, or the application of geological knowledge to a range of engineering and environmental problems.

Department of Mining Engineering

Head of Department
Professor JM Galvin

Mining Engineering is concerned with the design, development and management of mines for the extraction of the earth's mineral and energy resources. Mining production whether underground, at the surface, offshore or on the sea floor is a technically advanced engineering activity and the mining engineering course caters for the present day and future requirements of the industry. The mining engineer is a front line executive in control of all phases of a mining project from evaluation of a coal or an ore deposit, the planning and development of its extraction, its processing on site, the safe disposal of waste products and the restoration of the environment during and after mining.

Most mining engineers are trained for careers in mine production and management and their engineering and managerial roles necessitate liaison with a range of experts, from those engaged in exploration geology, to those in end-product development and marketing. 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 mining engineer's training has an appeal to many other industries in that it combines excellence in a broad range of disciplines from science and engineering to economics of management of human resources. With such a background, mining engineers can easily adapt to work in almost any industry either on graduation or at a later stage in their career.

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.

Centre for Minerals Engineering

Director
Dr T Tran

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, please see the course outline for Course 3040 in the Chemical Engineering section.

Key Centre for Mines

Director
Dr MB Katz

The purpose of the Key Centre for Mines is to provide a full range of educational training and research services to the minerals industries.

Particular emphasis is being placed on continuing education, distance learning, special training and industry based research and development.

The industry sector being addressed by the Key Centre for Mines covers the exploration, extraction, and primary processing of mineral resources.

UNSW Groundwater Centre

Director
Dr J Jankowski

The Groundwater Centre was established in 1987 as a Federal National Centre (Centre for Groundwater Management and Hydrogeology). In 1992, the Centre was reorganised as a joint initiative of the Faculties of Engineering and Applied Science with the general objectives of improving and continuing teaching and research in groundwater studies.

The Centre offers specialised graduate courses in Groundwater Studies and carries out general teaching in Hydrogeology to Applied Science and Engineering postgraduate students.

Undergraduate Study

Course Outlines

Department of Applied Geology

The Applied Geology course provides a comprehensive education in all aspects of earth science. It leads to the award of a Bachelor of Science (BSc) degree in four stages normally taken over four years full-time study, with honours for students who perform with merit throughout the course program. The fourth stage can be taken part time over two years, normally Years 4 and 5.

Students learn the fundamental principles of geology through lectures, laboratory work, projects and field tutorials. At the same time they gain the practical skill and knowledge of geological applications necessary for employment in research, industry or government. Graduates are prepared by the course to enter any branch of the geological profession, or to undertake further studies leading to a Higher degree. They are also well equipped to change their field of employment as different opportunities arise.

No previous knowledge of geology is required to enter this course but a sound background in mathematics together with at least one other science subject is essential. Students who have not undertaken chemistry at HSC level should take chemistry at the introductory level (CHEM1401 and CHEM1101) in Year 1, and CHEM1201 in the summer session before commencing Year 2. Students, who have reached a satisfactory standard in HSC Geology may be offered an alternative program in Year 1.

Reciprocal courses are offered through the Board of Studies in Science and Mathematics in Geology (double major), Geochemistry, Geophysics, Earth and Environmental Science and courses that combine a single major in Geology with Physics, Chemistry, Mathematics or Botany and Zoology. These courses are all of three years full-time duration leading to a BSc at Pass level. An optional fourth year leading to Honours is available for students achieving a good academic standing.

3000
Applied Geology - Full-time

Bachelor of Science
BSc

		HPW S1	HPW S2	CP
Stage 1				
CHEM1401	Introductory Chemistry A *and*	6	0	15
CHEM1101	Chemistry 1A *and*	0	6	15
CHEM1201	Chemistry 1B	0	6	15
or				
CHEM1101	Chemistry 1A *and*	6	0	15
CHEM1201	Chemistry 1B	0	6	15
GEOL1101	Geological Processes *and*	5	0	15
GEOL1201	Geological Environments	0	5	15
one of:				
MATH1011	General Mathematics 1B	6	0	15
MATH1131	Mathematics 1A	6	0	15
MATH1141	Higher Mathematics 1A	6	0	15
and one of:				
MATH1021	General Mathematics 1C	0	6	15
MATH1231	Mathematics 1B	0	6	15
MATH1241	Higher Mathematics 1B	0	6	15
and either:				
PHYS1002	Physics 1	6	6	30
or				
PHYS1022	Introductory Physics	6	6	30
or				
BIOS1101	Evolutionary and Functional Biology	6	0	15
and either				
BIOS1201	Molecules,Cells and Genes	0	6	15
or				
BIOS1301	Biology of Australia Flora and Fauna	0	6	15
or				
GEOG1073	Environmental Processes and Analysis	0	6	15
and				
GEOG1064	Global Development, Economy and Environment in Australia	6	0	20

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

		HPW S1	HPW S2	CP
Stage 2				
GEOL2011	Mineralogy and Igneous Petrology	5	0	15
	Field	1	0	
GEOL2031	Sedimentology and Palaeontology	5	0	15
	Field	1	0	
GEOL2022	Petrology and Structural Geology	0	5	15
	Field	0	1	
GEOL2041	Geological Computing	3	0	7.5
GEOL2042	Geological Statistics	3*	0	7.5
GEOL2051	Introductory Geophysics	0	3*	15
	Field	0	1*	
GEOL2062	Geological Mapping	0	4	15
GEOL2072	Environmental Geology	0	3	7.5
GEOL2092	Geochemistry	0	3	7.5
General Education subject/s		2	2	15

Total HPW Session 1 20*
Total HPW Session 2 23*
Total Credit Points 120

**For 1996 only.*

Stage 3				
GEOL3011	Mineralogical Techniques	3	0	7.5
GEOL3021	Igneous and Metamorphic Processes	3.5	0	15
	Field	0.5	0	
GEOL3031	Stratigraphy and Basin Analysis*	4	0	22.5
	Field	2	0	
GEOL3052	Exploration Geophysics	0	3	15
	Field	0	1	
GEOL3072	Engineering Geology	0	3	7.5
GEOL3082	Structural Geology	0	3	15
	Field	0	1	
GEOL3092	Exploration Geochemistry	0	2	7.5
GEOL3101	Ore Deposits	5	0	15
	Field	1	0	
GEOL3102	Fossil Fuels and Non-metallic Resources	0	5	15
	Field	0	1	
General Education subject/s		2	2	15

Total HPW Session 1 21
Total HPW Session 2 21
Total Credit Points 135

Stage 4				
APSE0002	Social Issues in Applied Science	2	0	5
GEOL4111	Advanced Geological Techniques	6	0	15
GEOL4121	Professional Practice	4	0	15
GEOL4131	Special Topics in Applied Geology	8	0	25
GEOL4203	Field Project	0	20	60

Total HPW Session 1 20
Total HPW Session 2 20
Total Credit Points 120

3000
Applied Geology - Part-time

Bachelor of Science
BSc

Part-time study is only available in Stage 4

		HPW S1	HPW S2	CP
Stage 4 (P/T)				
APSE0002	Social Issues in Applied Science	2	0	5
GEOL4131	Special Topics in Applied Geology	8	0	25
GEOL4213	Field Project (P/T)	0	10	30

Total HPW Session 1 10
Total HPW Session 2 10
Total Credit Points 60

Stage 5 (P/T)				
GEOL4111	Advanced Geological Techniques	6	0	15
GEOL4121	Professional Practice	4	0	15
GEOL4213	Field Project (P/T)	0	10	30

Total HPW Session 1 10
Total HPW Session 2 10
Total Credit Points 60

Department of Mining Engineering

The Department 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.

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.

Some subjects in Years 3 and 4 of the course will be conducted at the Department's residential Underground Teaching Unit located at Wyee Coal Mine. This provides a unique opportunity for students to gain immediate practical insight into 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 Department, 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. The minimum requirement is 100 days which must be completed before graduation. The School assists students as much as possible in securing suitable vacation employment. Students are required to submit for assessment an industrial training report on the vacation and other relevant experience acquired.

		HPW S1	HPW S2	CP
Year 1				
CHEM1807	Chemistry 1 ME	6	0	15
MATH1131	Mathematics 1A *o*			
MATH1141	Higher Mathematics 1A	6	0	15
MATH1231	Mathematics 1B *or*			
MATH1241	Higher Mathematics 1B	0	6	15
MINE0010	Applied Mechanics	3	0	7.5
MINE0110	Stress Analysis 1	0	3	7.5
MINE0210	Introduction to Mining Engineering*	0	1	2.5
MINE0410	Technical Communication	0	2	5
MINE0710	Computing 1	0	2	5
PHYS1002	Physics 1	6	6	30

Total HPW Session 1 21
Total HPW Session 2 20
Total Credit Points 102.5

Year 2				
ELEC0807	Electrical Engineering 1E	0	3	7.5
GEOL5211	Geology for Mining Engineers 1	2	2	10
GMAT0441	Surveying for Engineers	0	4.5	11.5
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	7.5
MINE1320	Fluid Mechanics and Thermodynamics	2	1	7.5
MINE1321	Mine Water and Drainage	0	1	2.5
MINE1420	Elements of Mining	1	0	6
PHYS2920	Electronics	3	0	7.5
General Education subject/s		2	2	15

Total HPW Session 1 22
Total HPW Session 2 21.5
Total Credit Points 111

		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	3	0	7.5
MINE1132	Mining of Coal Deposits	3	0	7.5
MINE1231	Rock Mechanics	0	4	10
MINE1232	Soil Mechanics	0	2	5
MINE1330	Bulk Materials Handling and Transport	0	2	5
MINE1530	Power Supply in Mines	2	0	5
MINE1630	Excavation Engineering (Blasting)	2	0	5
MINE1631	Excavation Engineering (Machine Mining)	0	1	2.5
MINE1830	Mine Ventilation and Environment	0	4	10
MINE1930	Industrial training	0	0	0
MINE7342	Minerals Engineering Processes	2	2	10
General Education subject/s		2	2	15

Total HPW Session 1 20
Total HPW Session 2 20
Total Credit Points 120

Year 4				
APSE0002	Social Issues in Applied Science	2	0	5
MINE1140	Geotechnical Engineering	2	2	10
MINE1740	Mining Legislation	0	2	5
MINE2141	Mineral Economics	2	0	5
MINE2142	Mine Planning and Design	3	3	15
MINE2240	Mining Management	0	3	7.5
MINE3040	Mine Safety Engineering	0	3	7.5
MINE3041	Hazard and Risk in Mining	2	0	5
MINE4140	Minerals Industry Project	4	4	20
MINE4240	Industrial and Research Seminars	1	1	5
MINE4540	The Mining Engineering Profession in Society	0	2	5

together with an approved group of *two* advanced elective subjects selected from the following:

Advanced Electives

MINE1940	Tunnel Engineering and Shaft Sinking	2	0	5
MINE7440	Mineral Process Technology	2	0	5
MINE3140	Computational Methods in Geomechanics	2	0	5
MINE3240	Operations Research	2	0	5

Total HPW Session 1 20
Total HPW Session 2 20
Total Credit Points 105

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 years of the combined degree course are therefore identical to course **3620**. At the end of Year 3, students may apply to enter the Bachelor of Engineering in Mining Engineering Course **3146** which is administered by the School of Mines in the Faculty of Applied Science.

Year 4
CIVL4006, CIVL4203, CIVL4306, CIVL4502, CIVL4605, CIVL4704, CIVL4822, CIVL4906
GEOL5311
MINE1320, MINE1231, MINE1420, MINE1630, GMAT0580

Year 5
ELEC0802
MINE1330, MINE1131, MINE1132, MINE1140, MINE1530, MINE1740, MINE1830, MINE1940, MINE2141, MINE3040, MINE7342, MINE7440
PHYS2920

Graduate Study

A number of coursework Masters degrees and Graduate Diplomas are available through the School of Mines. In addition, the School offers research degrees as follows:

Doctor of Philosophy PhD in Applied Geology **1000**, Mining Engineering **1050**, Master of Engineering ME in Mining Engineering **2180** and Master of Science MSc in Applied Geology **2000** and Mining Engineering **2060**.

Course Outlines

Department of Applied Geology

8022
Applied Geology

Master of Applied Science
MAppSc

Master of Applied Science courses in Applied Geology are designed to give advanced training in developing specialisations within geology and are structured specifically for candidates from industry to take on a part-time basis.

Specialist programs currently offered are in the fields of Engineering Geology, Hydrogeology, Environmental Geology, Groundwater Studies and Geological Data Processing.

8022.1000
Engineering Geology/ Hydrogeology/Environmental Geology

This is a flexible program covering a range of geotechnical disciplines. Completion of the course requires 120 credit points of which up to 96 (and no less than 60) credit points should be coursework subjects. The balance is made up of a research project of 24, 26 or 60 credit points which may be completed internally or externally. Most subjects are given in the first session, but some are available in second session, or in short course or external format. Core subjects are recommended but not compulsory. Intending students should discuss their choice of subjects with the Program Director, Mr GH McNally.

Core Subjects		**CP**
CIVL9788	Site Investigation	12
CIVL9860	Investigation of Groundwater Resources	12
GEOL9030	Geotechnical Engineering	12
GEOL9040	Fundamentals of Geomechanics	12
GEOL9060	Environmental Geology	12
Project		**CP**
GEOL9444	Project *or*	24
GEOL9454	Project *or*	36
GEOL9464	Project	60
Elective Subjects		
CIVL9790	Stability of Slopes	12
GEOL0110	Geological Remote Sensing	12
GEOL9031	Engineering Geology of Surficial Deposits	12
GEOL9032	Soil and Rock Construction Materials	12
GEOL9033	Terrain Evaluation	12
GEOL9070	Engineering Geophysics	12

Other elective subjects may be drawn from those offered by the Key Centre for Mines, UNSW Groundwater Centre and the School of Civil Engineering.

8022.2000
Groundwater Studies

This program is coordinated through the UNSW Groundwater Centre. Candidates are required to complete 120 credit points, made up of the five core subjects, elective subjects and a project. The degree may be taken internally on a full-time (normally 2 sessions) or a part-time (normally 4 sessions) basis. The course of study must be approved by the Head of School or the Head's nominee with core subjects totalling 60 credit points.

Core Subjects		
CIVL9860	Investigation of Groundwater Resources	12
CIVL9875	Hydrological Processes	12
CIVL9891	Groundwater Contamination and Remediation	12
GEOL9010	Groundwater Environments	12
GEOL9051	Hydrogeochemistry	12
Project		
GEOL9124	Groundwater Project *or*	36
GEOL9144	Groundwater Project	48

Elective Subjects		CP
CIVL9799	Environmental Geomechanics	12
CIVL9880	Groundwater Modelling	12
CIVL9890	Spatial Decision Support Systems in Water Resources	12
GEOL9052	Advanced Hydrogeochemistry	12
GEOL9070	Engineering Geophysics	12
GEOL9100	Remote Sensing of Groundwater Resources	12
KCME1110	Geographic Information Systems in Applied Geology	12

Business Management

KCME4201	Export Marketing for the Mining Industry
KCME4202	Mine Evaluation and Project Assessment
KCME4203	Mine Management
KCME4204	Exploration Project Management
KCME4301	Environmental Management for the Mining Industry

or such other subjects as the course authority may deem to be appropriate and equivalent.

**For students with an adequate background in computing and statistics this subject may be replaced by an additional elective subject. The approval of the course authority is required.*

8022.3000
Geological Data Processing

This program is intended for industry-based geologists who wish to enhance their skills in the computer processing of geological data. It is delivered as a series of separate academic subjects, each consisting of a one week residential short course with additional assignment material and an industry-based project. The short courses are scheduled to allow the degree program to be completed on a part-time basis over two years. The program allows an emphasis to be placed on data processing in mineral exploration, exploration geochemistry, ore reserve estimation, image processing and remote sensing, exploration geophysics or fossil fuel deposits. Optional subjects are also available to provide complimentary training in topics such as mine and environmental management and project evaluation.

Candidates are required to complete a course of 120 credits including either a 24 or 48 credit point project. Alternative subjects may be substituted in the published program at the discretion of the Head of the Department.

Core Subjects (12 credit points)

GEOL0300	Computing and Statistics for Geologists*
GEOL0310	Image Processing of Spatial Data Sets
GEOL0320	Geostatistical Ore Reserve Estimation

Project

GEOL0304	Project 1 (24 credit points) *or*
GEOL0314	Project 2 (48 credit points)

Elective Subjects (12 credit points)
Technical

GEOL0330	Conceptual Models for Exploration Geology
GEOL0340	Geochemical Exploration Techniques
GEOL0350	Exploration Geochemical Data Processing
GEOL0360	Remote Sensing Applications in Geoscience
GEOL0370	Fundamentals of Exploration Geophysics
GEOL0380	Electrical Methods in Geophysical Exploration
GEOL0390	Data Processing for Fossil Fuel Resources
KCME1106	Soil and Rock Construction Materials
KCME1108	Applied Structural Geology
KCME1109	Geophysics for Mine Development
KCME1110	Geographical Information Systems in Applied Geology
KCME4133	An Introduction to Environmental Geology
KCME4302	Environmental Assessment
KCME4303	Mine Geology and Grade Control

1000
Doctor of Philosophy (PhD) and
2000
Master of Science (MSc)

Research may be undertaken in fundamental or applied aspects of Geology. Collaborative programs with industry and government are encouraged. The following lists should not be considered as limiting the possible scope of any research project.

Mineral and Energy Resources
Exploration Geochemistry
Exploration Geophysics
Mineral Exploration
Ore Forming Processes
Resource Economics
Remote Sensing in Exploration
Image Processing
Petroleum and Coal Geology
Non metallic Mineral Resources
Marine Geophysics
Mathematical Geology
Sedimentary Basin Analysis
Geological Data Processing

Engineering and Environmental Studies
Environmental Geology
Engineering Geology
Geomechanics
Clays and Aggregates
Coastal and Estuarine Geology

Hydrogeology and Waste Management
Hydrogeology
Contaminant Hydrogeology
Groundwater Geophysics
Groundwater Studies and Modelling
Waste and Landfill Disposal
Groundwater Contaminant Transport

Fundamental Geological Studies
Palaeontology
Micro palaeontology
Petrology
Stratigraphy
Sedimentology
Structural Geology
Antarctic Geology
Marine Science

Alternative Graduate Programs

Alternative Graduate Programs in association with the Department of Applied Geology are available in the following areas:

Department of Safety Science
8045 Environmental Studies Graduate Course (MEnvStudies)

School of Geography
5047.2000 Graduate Diploma in Remote Sensing (GradDip)
8047.2000 Remote Sensing Graduate Course (MAppSc)

Faculty of Engineering
5496 Graduate Diploma in Remote Sensing (GradDip)
8641 Remote Sensing Graduate Course (MEngSc)

Department of Mining Engineering

8055
Mining and Mineral Engineering Graduate Course

Master of Applied Science
MAppSc

This course is offered to provide postgraduate training in subjects appropriate to the mining industry. There is a core of professional subjects, and the electives needed to complete the course be taken to suit a graduates previous experience or a chosen career path.

The MAppSc course is linked with the Mining Management Graduate and Graduate Diploma Courses offered through the Key Centre for Mines, and transfer between these programs will be possible with appropriate credit for subjects completed.120 credit points in one year full time. The teaching components should be completed in two sessions. The subjects which are listed below may be offered in two formats dependent on class sizes and student skills, and in general should be completed within one session.

A full teaching session subject will comprise approximately fourteen weeks of lectures, tutorials, and any associated laboratory work. Alternatively, the lecture material may be offered as a one week short course module in conjunction with the Key Centre equivalent course. The module would be preceded and followed by appropriate reading and tutorials. Assessment will consist of a combination of assignments and examinations complement the lecture mode.

Due to the varied entry routes there will be a difference of skills among candidates. Consequently there are two prescribed core courses, one for non-mining entrants, and the other for qualified mining graduates and entrants from the Graduate Diploma course. Exemptions may be given from one or more core subjects to appropriate candidates but a full complement of 120 credit points must still be attained.

Entry for Four Year Graduates - Non-Mining

Core Subjects		**CP**
MINE0130	Principles of Mining	8
MINE1224	Mining Engineering Technology	24
MINE1524	Mining Conservation	12
MINE3114	Mineral Beneficiation	12
Project		
MINE5064	Minor Project	24
MINE5124	Project *or*	46
MINE5184	Major Project	72

Entry for Graduates in Mining Engineering or from Course 5040

Core Subjects		
MINE5324	Principles of Mining Engineering (2)	24
MINE1524	Mining Conservation (1)	12
and either		
MINE3224	Mineral Beneficiation Technology or	24
MINE4424	Mineral Industry Analysis	10
Project		
MINE5064	Minor Project *or*	24
MINE5124	Project *or*	48
MINE5184	Major Project *or*	72
MINE3654	Minerals Engineering Project	36

Notes:
(1) or equivalent subject from Key Centre for Mines
(2) Minerals Engineering candidates may be permitted to substitute electives if they have a mining industry background.
(3) The choice of project is subject to approval from the Head of School.

Elective Subjects for all candidates
(8 credit points)

MINE5655	Rock Slope Stability
MINE5755	Subsidence Engineering
MINE9174	Fire and Explosion

(12 credit points)

GEOL0300	Computing and Statistics for Geologists
GEOL0330	Geostatistical Ore Reserve Estimations
GEOL0390	Conceptual Models for Exploration Geology
MINE0014	Exploration Drilling
MINE1514	Ground Control and Excavation Engineering
MINE1534	Environmental Conditions in Mines
MINE1544	Rock Excavation and Transportation
MINE3514	Mineral Beneficiation Plant Design
MINE3634	Minerals Engineering Laboratory
MINE4424	Minerals Industry Analysis
MINE4055	Numerical Methods in Geomechanics
MINE4155	Stability of Slopes
MINE5155	Rock Mechanics Measurements
MINE5255	Strata Control Engineering
MINE5355	Mine Fill Technology
MINE5455	Advanced Rock Cutting Technology

MINE5555	Blasting Technology
MINE9364	Equilibrium Concepts in Water Systems
MINE9374	Hydrogeochemistry
MINE9415	Advanced Rock Mechanics

(24 credit points)

MINE3224	Mineral Beneficiation Technology
MINE3614	Minerals Engineering 1
MINE3624	Minerals Engineering 2
MINE3644	Minerals Engineering 3

Notes:

(1) Any Key Centre module may also be taken, subject to (2).

(2) Electives must be chosen on enrolment and approved by the Course Director; some electives are mutually exclusive.

(3) Attention is also drawn to subjects available from the for Department of Safety Science, the Centre for Waste Management and the School of Chemical Engineering. Subjects to timetables and minimum class sizes in various departments, electives may be chosen from those and other course authorities.

(4) Not all electives in the above list will be offered each year.

5040
Mining and Mineral Engineering Graduate Diploma Course

Graduate Diploma
GradDip

The Graduate Diploma course in Mining and Mineral Engineering serves two purposes. It can provide a professional introduction to the mining industry for graduates in Science, Applied Science or Engineering and it is a qualifying course for entry to the Master of Applied Science and Master by Research programs.

The Graduate Diploma will be awarded after successful completion of one year full-time or two years part-time study. The course is a blend of lecture and laboratory work and an appropriate choice of the laboratory work and project can lead to some specialisation in either mining engineering or minerals engineering. When appropriate, some sections of the course may be offered as a unit 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 and on that basis up to 120 credit points of undergraduate subjects may be substituted for the topics shown where appropriate to the skills of the student concerned.

Full-time Program

		CP
MINE0130	Principles of Mining	8
MINE1114	Mining Engineering	24
MINE1224	Mining Engineering Technology *or*	24
MINE3224	Mineral Beneficiation Technology	24
MINE1324	Mining Engineering Laboratory and Project *or*	32
MINE3324	Mineral Engineering Laboratory and Project	32
MINE3114	Mineral Beneficiation	12
MINE7140	Mineralogical Assessment	4
MINE7341	Mineral Process Engineering	8
Totalling		30

Part-time Program

This should be discussed with the Head of Department. In principle, the part-time program should be completed in two years by taking approximately 15 credit points in each year. MINE1224 and MINE1324, or MINE3224 and MINE3324 would be taken in the second year.

Electives

Subjects with a value of up to 24 credit points taken from within the School of Mines may be substituted for those listed above, subject to approval by the Course Director. Subjects from other courses in the University may also be chosen by agreement with the appropriate Head of School.

Key Centre for Mines

8057
Master of Mining Management
MMinMgmt

5057
Graduate Diploma in Mining Management
GradDipMinMgmt

The courses are designed to give mining personnel the opportunity to extend their career paths into management levels. Candidates will be able to select course work modules from Business Management and Science and Technology Streams. The delivery of the course work modules has been designed to enable the participation of professional staff in the minerals industries no matter how remote the location of their particular operation. This delivery will either be in the form of one week short courses, with follow-up assignments, or by correspondence only. Each module is of 12 credit points value. In normal circumstances no more than two modules may be undertaken by correspondence.

It is anticipated that candidates will come from a wide range of educational and training backgrounds. The normal entry qualification for the Graduate Diploma is a relevant three-year degree or equivalent. This may be demonstrated by equivalent experience and/or the holding of a position of appropriate responsibility. The normal entry qualification for the Masters Degree is a relevant four-year degree or equivalent. This may be demonstrated by equivalent experience and/or the holding of a position of appropriate

responsibility. A preliminary program is available for candidates who do not fully meet the normal requirements.

A 36 credit point industry-based project and five modules are required for the GradDipMinMgmt with a minimum of two from either the Business Management or the Science and Technology Streams. For the Master of Mining Management it is necessary to complete eight modules, with a minimum of three from either stream. The Master's program also includes an industry-based project equivalent to one third of the course. The courses will be structured in a way that allows movement between the two programs in some circumstances; a graduate of the GradDipMinMgmt course may be able to continue to a MMinMgmt by completing a further three modules and the larger industry-based project.

Assessment is by assignment for most modules but may be by formal examination. Examination of the correspondence components of the course is undertaken at a number of regional centres.

Science and Technology Modules (12 credit points)

KCME1102	Mine Safety Management*
KCME1103	Drilling and Blasting
KCME1105	Slope Stability for Surface Mining
KCME1106	Soil and Rock Construction Materials
KCME1107	Introductory Computing for Geologists and Mining Engineers
KCME1108	Applied Structural Geology
KCME1109	Geophysics for Mine Development
KCME1302	Mine Ventilation and Environment
KCME2101	Strata Control
KCME2104	Application of Computers in the Mining Industry
KCME2105	Geostatistical Ore Reserve Estimation
KCME2107	Mine Water Origin, Inflow, Prediction and Control
KCME3101	Coal Preparation
KCME4102	Placer Technology
KCME4133	An Introduction to Environmental Geology
KCME4301	Environmental Management for the Mining Industry*
KCME4302	Environmental Assessments
KCME4303	Mine Geology and Grade Control

Business Management Modules (12 credit points)

KCME1102	Mine Safety Management*
KCME3201	Financial Management**
KCME3202	Management Perspectives**
KCME3203	Economic Decision Making**
KCME3204	Management of Innovation**
KCME3205	Strategic Planning**
KCME3206	Mining Law
KCME4201	Export Marketing for the Minerals Industry
KCME4202	Mine and Project Evaluation
KCME4203	Mine Management
KCME4204	Mineral Exploration Project Management
KCME4301	Environmental Management for the Mining Industry*

**May be taken as either a Science and Technology or a Business Management module*

***May be offered by correspondence*

Industry-Based Projects

KCME1300	Mining Management Project 48 credit points (course 8057 only)
KCME1400	Mining Management Project 36 credit point (course 5057 only)

Unless otherwise stated all modules are of 12 credit points value.

Equivalent or additional courses can be added at the discretion of the Head of the School of Mines.

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:
Department of Applied Geology - School Office
Department of Mining Engineering - Dr AK Bhattacharyya
CP5 S1 L1 T1

Social Issues and the Applied Sciences 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.

GEOL0004
Special Program Applied Geology
Staff Contact: Dr AC Dunlop, Mr GH McNally
CP120
Note/s: For programs **8022.1000, 8022.2000** and **8022.3000**

GEOL0005
Research Thesis Applied Geology Full-time
Staff Contact: Dr AC Dunlop
CP120
Note/s: For programs **1000** and **2000**

GEOL0006
Research Thesis Applied Geology Part-time
Staff Contact: Dr AC Dunlop
CP60
Note/s: For programs **1000** and **2000**

GEOL0110
Geological Remote Sensing
Staff Contact: A/Prof GR Taylor
CP12 S1 L4 HPW3

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; infrared remote sensing techniques; side looking airborne radar; theory and applications of Landsat imagery; enhancement techniques for satellite imagery; interpretation of Landsat photographic products and application to several case history areas. Integration of remote sensing information with the overall data base as applied to exploration.

GEOL0114
Project in Geological Remote Sensing
Staff Contact: A/Prof GR Taylor
CP48
Note/s: Restricted to program **8026**

GEOL0300
Computing and Statistics for Geologists
Staff Contact: Dr DR Cohen
CP12 SS L2 T1

Introduction to the use of PC's, operating systems, communications and networks, common software packages. An introduction to programming, spreadsheets, graphics software and the SYSTAT package. Fundamentals of statistics including types of data, population characterisation, tests of significance, analysis of variance and basic geostatistical methods.

GEOL0304
Data Processing Project 1
Staff Contact: A/Prof GR Taylor
CP24 SS

A minor project equivalent to 6HPW study for one session which will require the student to carry out detailed processing and analysis of a comprehensive data set for an exploration project that may relate to the student's field of employment.

GEOL0310
Image Processing of Spatial Data Sets
Staff Contact: A/Prof GR Taylor
CP12 SS L2 T1

Data sources and formats, remotely sensed, geophysical, geochemical and topographic. Image display systems; data pre-processing, image rectification, spatial filtering and enhancement techniques. Statistical analysis, classification and image display as a tool for data integration.

GEOL0314
Data Processing Project 2
Staff Contact: A/Prof GR Taylor
CP48 SS

A research project equivalent to 12 HPW study for one session which requires the student to carry out detailed processing, analysis and integration of a multi-attribute data set for an exploration project that may relate to the student's field of employment.

GEOL0320
Geostatistical Ore Reserve Estimation
Staff Contact: Key Centre for Mines Office
CP12

When to apply geostatistics; brief review of univariate statistics; bivariate statistics and correlation; exploratory data analysis; measures of spatial correlation: the variogram, the covariance; variogram calculation and how to obtain a good variogram; random function models and stationarity; desirable properties of estimators; estimation of variance; dispersion variance and uses; optimal weighted average estimator, ordinary kriging; recoverable reserve estimation, problems and solutions; application examples, coal, copper, gold; blasthole kriging for orewaste selection; geotechnics and the environment.

GEOL0330
Conceptual Models for Exploration Geology
Staff Contact: Dr AC Dunlop
CP12 SS L2 T1

The development and use of ore deposit models as a guide for exploration. Examples drawn from the major categories of deposit such as epithermal gold, greenstone associated gold, vein-type uranium, porphyry coppers, volcanogenic massive sulphides, carbonate and shale-hosted lead-zinc and ultramafic hosted nickel sulphides. Exploration strategies and tactics; risk analysis and prospect evaluation.

GEOL0340
Geochemical Exploration Techniques
Staff Contact: Key Centre for Mines Office
CP12 SS L2 T1

Regolith development and element mobility. Principles of exploration geochemistry and its role in mineral exploration. Detailed consideration of soil, rock and drainage sampling interpretation techniques. Consideration of appropriate analytical techniques. Problems related to Australian and other regional environments examined on the basis of case histories.

GEOL0350
Exploration Geochemical Data Processing
Staff Contact: Dr DR Cohen, Dr AC Dunlop
CP12 SS L2 T1

Graphical analysis of exploration geochemical data using boxplot, stem and leaf display and quantile plotting techniques; identification of anomalous observations. Correlation of geochemical variables; principal component analysis and identification of geochemical processes. Regression analysis and adjustment of background populations in geochemical data. Discriminant function analysis and factor analysis. Spatial filtering and definition of geochemical anomalies and regional distribution patterns of elements. Introduction to robust statistical methods. New developments in geochemical data processing. Data visualisation.

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.

GEOL0370
Fundamentals of Exploration Geophysics
Staff Contact: Mr D Palmer
CP12 SS L2 T1

An introduction to the theory and application of geophysical methods to engineering, environmental, and groundwater studies. The methods covered include gravity, magnetic seismic refraction, shallow seismic reflection, DC electrical resistivity, electromagnetic, transient electromagnetic, radar, and geophysical well logging. Each method is described in terms of the fundamental physical principles, data acquisition and field techniques, data processing and presentation, and quantitative interpretation.

GEOL0380
Electrical Methods in Geophysical Exploration
Staff Contact: Mr D Palmer
CP12 SS L2 T1

The relationships between geology and electrical geophysical properties; basic theory of resistivity, induced polarisation and electromagnetic methods. Evaluation of applications, survey design, instrumentation, data acquisition, interpretation and productivity. Computer methods of interpretation are emphasised by the extensive use of hands-on microcomputer tutorials. An introduction to recent advances in electrical geophysics: inversion, multi-electrode array resistivity, spectral induced polarisation, transient electromagnetics and ground probing radar.

GEOL0390
Data Processing for Fossil Fuel Resources
Staff Contact: A/Prof C R Ward
CP12 SS L2 T1

Sedimentary basin analysis with special emphasis on the geology of coal deposits; coal deposit evaluation, data acquisition, computer processing, analysis and display.

GEOL1101
Geological Processes
Staff Contact: Dr MD Buck
CP15 S1 L3 T2
Prerequisites: HSC mark range required - 2 unit Mathematics 60-100, 2 and 3 unit Mathematics 1-50, or 3 and 4 unit Mathematics 1-100, and 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 4 unit Science 1-50, or 3 unit Science 90-150
Note/s: Up to 2 days of fieldwork is a compulsory part of this subject. Students will incur personal costs. Details will be provided during the first week of the subject.

Stream 1
The Solar System. Origin of the Earth. The Earth's internal structure. Continental drift and plate tectonics. The origin of igneous, metamorphic and sedimentary rocks. Geological hazards. Geological time and dating. Structural geology, origins of faults and folds. Origins and circulations of oceans and atmosphere.

or
Stream 2
Available only with permission of the Head of School.
A program of projects and independent study of selected aspects of geology. Assessment includes practical and theory examinations.

GEOL1201
Geological Environments
Staff Contact: Dr MD Buck
CP15 S2 L3 T2
Prerequisites: GEOL1101
Note/s: Up to 4 days of fieldwork is a compulsory part of this subject and may be held in the last week of the mid-year recess. Students will incur personal costs. Details will be provided during the first week of the subject.

Fossils, dinosaurs, mammals and man. Evolution of life. Principles of stratigraphy. Air photo interpretation and geological mapping. Economic and energy resources.

Environmental geology. Climates and processes of the recent past. Global geophysics. Coastal geology.

GEOL2011
Mineralogy and Igneous Petrology
Staff Contact: Dr PC Rickwood, A/Prof BJ Hensen
CP15 S1 L2 T3
Prerequisite: GEOL1201
Note/s: Fieldwork of up to 4 days is a compulsory part of this subject and may be held in the last week of the mid-year recess. Students will incur personal costs. Details will be provided during the first week of the subject.

Mineralogy. Principles of optical crystallography and the use of the transmitted light polarising microscope. Chemical and physical properties of rock forming minerals. Mineral identification. Igneous Petrology. Occurrence, classification and origin of igneous rocks. Fractional crystallisation and differentiation. Partial melting. Simple binary melting diagrams. Igneous petrology relating to plate tectonics. Macroscopic and microscopic examination of rock forming minerals and igneous rocks in the field and the laboratory.

GEOL2022
Petrology and Structural Geology
Staff Contact: Dr MD Buck, A/Prof BJ Hensen, Dr PG Lennox
CP15 S2 L3 T2
Prerequisite: GEOL2011
Note/s: Fieldwork of up to 4 days, is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Sedimentary Petrology. The influence of transportation, deposition and diagenesis on the composition, texture and structure of detrital sedimentary rocks. The non-clastic sedimentary rocks including phosphates, evaporites; ferruginous and siliceous deposits. Metamorphic Petrology. Origin and classification of metamorphic rocks as an aid in understanding common mineral assemblages. Petrographic studies of common metamorphic rocks. Field studies. Structural Geology. Origin, classification and description of structural elements and analysis of simple fracture systems. Tectonics and tectonic analysis.

GEOL2031
Sedimentology and Palaeontology
Staff Contact: A/Prof CR Ward, A/Prof AD Albani
CP15 S1 L3 T2
Prerequisite: GEOL1201
Note/s: Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Sedimentology. Flow regimes and bedding forms, sedimentary structures. Modern and ancient sedimentary environments of deposition: alluvial, near-shore, shelf and deep-sea, in both terrigenous clastic and carbonate domains. The facies concept: lateral and vertical relationships between depositional environments and associated lithofacies. Palaeontology. Morphology and geological significance of invertebrates including Foraminifera, Coelenterata, Brachiopoda, Mollusca, Arthropoda, Echinodermata and Protochordata. Introductory paleobotany, ichnology (trace fossils) and biostratigraphy.

GEOL2041
Geological Computing
Staff Contact: Dr DR Cohen
CP7.5 S1 L2 T1
Prerequisite: GEOL1101

Introduction to the use of PCs, networking with emphasis on geological software. Introduction to programming with statistical applications pertinent to geoscience. Introduction to statistical theory.

GEOL2042
Geological Statistics
Staff Contact: Dr DR Cohen
CP7.5 S1 L2 T1 (S1 in 1996 only)
Prerequisite: GEOL2041

Introduction to geostatistics, population characterisation and splitting. ANOVA methods, regression analysis, EDA, Markov chains, analysis of orientated data and processing of spatial geological data.

GEOL2051
Introductory Geophysics
Staff Contact: Mr D Palmer
CP15 S2 L2 T1 (S2 in 1996 only)
Prerequisite: GEOL1101
Note/s: Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Principles of gravity, geomagnetism, palaeomagnetism, geothermy and seismology and their relation to shape, internal constitution and dynamic processes of the earth. Introduction to radiometric, gravity and magnetic exploration methods.

GEOL2062
Geological Mapping
Staff Contact: A/Prof AD Albani, Mr G McNally
CP15 S2 L2 T1
Prerequisite: GEOL1101 or GEOL1201
Note/s: Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs. Details will be provided during the first week of this subject.

The geological use of levels, tacheometers and theodolites; instrumental errors and their correction. Precision of angular and distance measurements. Stadia surveying and its application to detailed geological mapping involving both closed and open traverses. Field computations. Map projections, coordinate systems and the Australian Mapping Grid. System transformations. The use of air photos for geological mapping and geomorphological evaluation of the land. Techniques and principles of aerial photography. Photo-interpretation of geological features. Relationships between geology, drainage, soil and vegetation. An introduction to remote sensing.

GEOL2072
Environmental Geology
Staff Contact: Mr GH McNally, A/Prof AD Albani, Dr J Jankowski
CP7.5 S2 L2 T1

Land degradation, problem soils, engineering geomorphology, geological hazards. Water resources and pollution. Land use conflicts. Hydrogeology. The hydrological cycle; confined and unconfined groundwater. Hydrological characteristics of rocks and their measurement. Pump tests. Aquifer boundaries.

Exploration for groundwater development and monitoring groundwater resources. Groundwater flow tests. Case studies from the Great Artesian Basin and the Murrumbidgee area. Coastal Geology. Properties of sedimentary populations. Sampling practice and analysis of measured data. Geological implications of sediment parameters. Coastal environmental assessment. Shoreline processes. Geological evolution of the inner continental shelf.

GEOL2092
Geochemistry
Staff Contact: Dr PC Rickwood
CP7.5 S2 L2 T1
Prerequisite: GEOL1201

Basic principles of modern methods of analysis of silicates. Accuracy, precision and quality of geochemical data. Norms. Graphical display of analyses. Geochemical maps and elementary GIS systems. Geochemical classification of elements; basic crystal chemistry. The natural distribution of elements in terrestrial rocks. Heavy metals in unconsolidated sediments. Radiogenic nuclides and their use in dating rocks and minerals. The nature and origin of meteorites and tektites.

GEOL3011
Mineralogical Techniques
Staff Contact: Dr PC Rickwood
CP7.5 S1 L2 T1
Prerequisite: GEOL1201

Principles of X-ray powder diffractometry and the use of X-ray powder cameras and diffractometers. Elementary stereology. Laboratory methods of mineral separation. Mineral characterisation.

GEOL3021
Igneous and Metamorphic Processes
Staff Contact: A/Prof BJ Hensen
CP15 S1 L2 T1.5
Prerequisite: GEOL2011 and GEOL2022
Note/s: Fieldwork of up to 3 days is a compulsory part of this subject. Students will incur personal costs. Details will be provided during the first week of the subject.

Igneous Petrology. Origin of silicate liquids. High pressure and low pressure fractionation. Liquids and fluids. Nature of the upper mantle. The use of trace elements and isotopes as petrogenetic indicators. Practical petrography and literature studies of igneous suites. Field study. Metamorphic Processes. Metamorphic reactions. Isograds. Mineral assemblages as geobarometers and geothermometers. Fluids in metamorphism. Pressure, temperature, time-paths and tectonic setting of metamorphism in the earth's crust. Metamorphic petrology of Australia. Practical macroscopic and microscopic study of metamorphic suites from different tectonic regimes.

GEOL3031
Stratigraphy and Basin Analysis
Staff Contact: Prof J Roberts
CP22.5 S1 L2 T2
Prerequisite: GEOL1201
Note/s: Fieldwork of up to 8 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Stratigraphy. Geological evolution of the Australian continent. Depositional regions within and adjacent to continents, island arcs and ocean basins. Development of the Pre-Cambrian craton. Palaeozoic-Mesozoic evolution of the eastern Australian mobile belt. Intracratonic basins of western and southern Australia and development of divergent margins. The northern collision zone. Palaeontology. Processes and theories of evolution. Theories of biological classification.

Basin analysis. Basin classification. Data gathering from outcrop and the subsurface. Drilling methods, description of cores and cuttings, petrophysical well logging. Lithofacies analysis, lithofacies maps, palaeocurrents, palaeographic maps. Provenance studies in sedimentary basins. Controls on basin stratigraphy, sea level change, sequence stratigraphy, depositional systems, systems tracts; application of depositional systems to the interpretation of sedimentary basins.

GEOL3052
Exploration Geophysics
Staff Contact: Mr D Palmer
CP15 S2 L2 T1
Prerequisite: GEOL1201
Note/s: Fieldwork of up to 3 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

An introduction to the theory and application of geophysical methods to mineral, petroleum, coal, groundwater, and geotechnical studies. The methods covered include gravity, magnetic seismic refraction, shallow seismic reflection, DC electrical resistivity,induced polarization, electromagnetic, transient electromagnetic, radar, and geophysical well logging. Each method is described in terms of the fundamental physical principles, data acquisition and field techniques, data processing and presentation, and quantitative interpretation.

GEOL3072
Engineering Geology
Staff Contact: Mr GH McNally
CP7.5 S2 L2 T1
Intact rock, discontinuities and rock masses; weathering; engineering properties and testing of soils; soil and rock mechanics fundamentals; soil and rock as construction materials; applications of geology in the investigation and design of roads, dams, tunnels and mines.

GEOL3082
Structural Geology
Staff Contact: Dr PG Lennox
CP15 S2 L2 T1
Prerequisite: GEOL2022
Note/s: Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Structural Geology. Structural analysis at the microscopic, mesoscopic and macroscopic scales. Structural analysis using Bermagui, Cooma and Broken Hill Terrains. Folds, faults and foliation development. Strain analysis, deformation mechanisms and the relationship between deformation and metamorphism.

GEOL3092
Exploration Geochemistry
Staff Contact: Dr AC Dunlop, Prof GJS Govett, Dr DR Cohen
CP7.5 S2 L2
Prerequisites: GEOL2092 and GEOL3101

Principles and techniques of soil drainage and rock geochemistry as applied to mineral exploration.

GEOL3101
Ore Deposits
Staff Contact: Dr AC Dunlop
CP15 S1 L3 T2
Prerequisite: GEOL2022 and GEOL2092
Note/s: Fieldwork of up to 4 days is a compulsory part of this subject and will be held in the last week of the mid-year recess. Students will incur personal costs. Details will be provided during the first week of the subject.

Geological setting, characteristics and genesis of the major categories of ore deposits. Laboratory study of hand specimens, thin sections and polished sections from these ore deposit categories.

GEOL3102
Fossil Fuels and Non-metallic Resources
Staff Contact: A/Prof CR Ward, Dr P G Lennox
CP15 S2 L3 T2
Prerequisites: GEOL1201
Note/s: Fieldwork of up to 3 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Coal Geology. Nature and properties of coal. Methods of testing and analysis. Introduction to coal petrology. Origin of coal seams and coal-bearing sequences. Coalfield exploration and coal mining geology. Geological factors in coal preparation and use. *Petroleum Geology.* Petroleum generation, including Kerogen types and maturation, migration, entrapment and degradation; sedimentary features of reservoir sequences; 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. *Non-metallic Minerals.* Occurrences and economic use of non-metallic and industrial minerals including limestone, silica, diatomite and asbestos. Clay Mineralogy. The structure and properties of the clay mineral groups including the kaolinites, illites, smectites, chlorites, mixed layered and fibrous clay minerals. Techniques for the identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. Industrial uses of clays and bauxite.

GEOL4111
Advanced Geological Techniques
Staff Contact: Dr PC Rickwood, Dr DR Cohen, A/Prof GR Taylor, A/Prof BJ Hensen
CP15 S1 L T6
Note/s: Fieldwork of up to 7 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Geochemical Techniques. Sampling strategy and methodology; preparation of samples for analysis. Practical usage of modern destructive and non-destructive methods of rock and mineral analysis including AAS, ICP, DCP, and XRF.

Geological Data Processing. Application of probability graphs to exploration data. Processing and interpretation of geological data using selected univariate and multivariate statistics; typical case studies in mathematical geology exemplifying these techniques. Practical work based on microcomputer operating systems, word processing, statistical and graphical packages.

Remote Sensing. Principles of various remote sensing techniques including Landsat and side-looking airborne radar. Techniques of image enhancement and digital processing. Applications of remote sensing in lithological mapping and tectonic analysis. Integration of remotely sensed data with conventional data sources. Practical work with the interactive computer on image analysis with particular reference to student field study areas. Field Work: A compulsory tutorial of up to seven days duration providing training in advanced mapping techniques and in the integrated use of multiple sources of field data.

GEOL4121
Professional Practice
Staff Contact: Prof J Roberts, Dr AC Dunlop
CP15 S1 L2 T2
Note/s: Formal classes are scheduled for 13 weeks only to accommodate the field tutorial of GEOL4111.

Project Management: Organisation and costing of geological field programs; land tenure, exploration and mining titles; design of drilling, sampling and analysis programs; use of geological database and modelling systems; estimation of resources and reserves; reporting requirements, liability and ethics in geological practice. Research and communication: Writing and illustration of scientific reports, theses and papers. Short written reports for editing in class; major report encompassing literature search and description of the thesis topic. Preparation of maps and other illustrations. Presentation of technical material in verbal form.

GEOL4131
Special Topics in Applied Geology
Staff Contact: Dr PG Lennox
CP25 S1 HPW8

Instruction by lectures, tutorials and assignments in advanced aspects of a chosen area of geological specialisation. Programs are offered in a number of specialised fields including Mineral Exploration and Mining Geology, Sedimentary Basin Studies, Geophysics and Engineering Geology, Environmental Geology, Geochemistry, Hydrogeology. Details of these programs are available from the Director of Fourth Year studies. The Special Topics program would normally be related to the topic of the chosen Field Project (GEOL4203, GEOL4213, GEOL4303 and GEOL4343) and is designed to be a preparation for a future career. Variation from the standard programs may be allowed subject to approval from the Head of Department.

GEOL4203
Field Project
Staff Contact: Dr PG Lennox
CP60 S2 HPW20
Note/s: Students will incur personal costs.

A major field/laboratory project, which generally includes geological mapping, on some aspect of mineral or sedimentary basin resources, engineering or environmental geology or resource geophysics.

GEOL4213
Field Project (P/T)
Staff Contact: Dr PG Lennox
CP30 S2 HPW10 (Year 1) S2 HPW 10 (Year 2)
Note/s: Students will incur personal costs.

A major field/laboratory project, which generally includes geological mapping, on some aspect of mineral or sedimentary basin resources, engineering or environmental geology or resource geophysics.

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: A/Prof CR Ward
CP7.5 S1 L1.5T5
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.

GEOL7321
Geology for Geomorphologists and Pedologists
Staff Contact: A/Prof CR Ward, A/Prof AD Albani
CP15 S1 L1 T1 S2 L2 T2
Prerequisites: GEOL1201
Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Clay Mineralogy. The structure and the properties of the clay groups, including the kaolinites, illites, smectites, chlorites, mixed-layered and fibrous clay minerals. Techniques for the identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. Industrial uses of clays and bauxite. *Sedimentology.* Properties of sedimentary populations. Sampling practices. Measurement of grain size, grain shape and packing; analysis of measured data. Geological significance of sediment parameters. *Coastal Geology.* The shoreline processes. Littoral and longshore drifts and net sand movement. Coastal engineering works. The estuarine environment; sedimentation, chemical and biological processes, investigation techniques.

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, dispersive soils and filter design. Foundation engineering.

GEOL9031
Engineering Geology of Surficial Materials
Staff Contact: Mr GH McNally
CP12 S2

Geotechnical characteristics of alluvial, colluvial, eolian, coastal and residual soils; duricrusts and deep water weathering; problem soils (expansive, dispersive, collapsing, compressible and saline); stabilisation and improvement of inferior materials; influence of Cainozoic climatic changes and geological history of regolith in Australia and adjacent areas.

GEOL9032
Soil and Rock Construction Materials
Staff Contact: Mr GH McNally
CP12 S2

Location and assessment of sand, gravel, hard rock, brick clay, building stone and limestone; specification and testing of aggregate, ballast and roadbase; concrete and asphaltic materials; blasting, crushing and benefication; environmental considerations, blast monitoring and quarry reclamation; waste and synthetic materials.

GEOL9033
Terrain Evaluation
Staff Contact: Mr GH McNally
CP12 S2

Introduction to photogeology and image interpretation, with emphasis on geotechnical applications; interpretation of geological structure, lithology and surficial deposits; terrain evaluation for engineering purposes, with Australian examples. Course content includes lectures, supervised practical work and individual assignments. Intended to complement GEOL0110 (Geological Remote Sensing), emphasising airphotos as a data source.

GEOL9040
Fundamentals of Geomechanics
Staff Contact: Mr GH McNally
CP12 S1 L1.5 T1.5
Note/s: This subject is being revised. Intending students should contact Mr G H McNally.

Engineering mechanics, limit equilibrium, equilibrium of multiple bodies, stress and strain in two and three dimensions, equations of equilibrium and compatibility. Isotropic and anisotropic elasticity, plastic and viscous yield criteria and potential surfaces. Stereographic projection methods for rock mechanics. Geomechanical properties and classification of soils and rocks. Laboratory and field testing techniques for soils and rocks. Deformability and strength properties of rocks and shear strength of rock discontinuities. Stresses about rock openings and beneath point loads. Stress measurement in rocks.

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.

GEOL9052
Advanced Hydrogeochemistry
Staff Contact: Dr J Jankowski
CP12 S2
Note/s: Not offered in 1996.

Environmental isotopes; radioactive decay; stable and radioactive isotopes and their application to groundwater studies; bacteriology: basic principles of bacteriology and microbiology of polluted environments; biochemistry, advanced thermodynamics and kinetics; mass transport and mass balance studies in groundwater systems; computer methods in geochemical modelling including forward and inverse methods and geochemical modelling codes; case studies and application of computer codes in groundwater modelling; practical field measurement and use of field hydrochemical equipment; laboratory analysis and the use of the chemical laboratory equipment.

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.

GEOL9070
Engineering Geophysics
Staff Contact: Mr D Palmer
CP12 S1 L2 T1
Note/s: Short field tutorials are included as part of this subject. Students will incur personal costs.

An introduction to the theory and application of geophysical methods to engineering, environmental, and groundwater

studies. The methods covered include gravity, magnetic seismic refraction, shallow seismic reflection, DC electrical resistivity, electromagnetic, transient electromagnetic, radar, and geophysical well logging. Each method is described in terms of the fundamental physical principles, data acquisition and field techniques, data-processing and presentation, quantitative interpretation, and case histories.

GEOL9100
Remote Sensing of Groundwater Resources
Staff Contact: Applied Geology Office
CP12 S1 L1.5 T1.5

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; infrared remote sensing techniques; sidelooking airborne radar; theory and applications of Landsat imagery; enhancement techniques for satellite imagery; interpretation of Landsat photographic products and application to several case history areas. Integration of remote sensing information with the overall database as applied to exploration. Remote sensing for hydrogeological mapping, recognition of aquifers and recharge, discharge zones, salinity mapping. Application of Landsat, TM, SPOT, RADAR and integrated information systems.

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.

GEOL9124
Groundwater Project
Staff Contact: Dr I Acworth
CP36 S2

Study of similar content to GEOL9144 but at a smaller scale.

GEOL9144
Groundwater Research Project
Staff Contact: Dr I Acworth
CP48 S2
Note/s: Students undertaking field work may incur personal costs.

Research investigation consisting of one or more of; modelling, laboratory experiments, field work related to groundwater studies.

GEOL9444
Project in Engineering Geology
Staff Contact: Mr GH McNally
CP24

Study of similar content to GEOL9464 but at a much smaller scale.

GEOL9454
Project in Engineering Geology
Staff Contact: Mr GH McNally
CP36

Study of similar content to GEOL9464 but at a smaller scale.

GEOL9464
Project in Engineering Geology
Staff Contact: Mr GH McNally
CP60
Note/s: students undertaking field work may incur personal costs

The project is a research investigation of field and laboratory work in any of the disciplines; Engineering Geology, Environmental Geology or Hydrogeology.

KCME1102
Mine Safety Management
Staff Contact: Prof J Cross
CP12
Note/s: Offered by correspondence

The course includes the following: safety management; hazard and risk analyses, safety hazard identification, management techniques (MORT STEP), safety audits; statistics: HAZOP management and maintenance of change risk analysis; cost benefit analysis; attitudes to safety in mining; safety and personal problems; effective training; accident and injury report/recovery; ergonomics and safety engineering; prevention of traumatic injury; work stress; environmental factors; monitoring and protection; personal protective equipment; safety policies and programs; action plans.

KCME1103
Drilling and Blasting
Staff Contact: Dr G Sen
CP12

Drilling methods, types of drills, types of bits and other accessories, drilling economics, maintenance schedules for drills and accessories; history and theory of explosives, explosive types; new developments and applications; blast design and secondary blasting; controlling ground vibration; airblast and flyrock; blasting economics; controlled blasting; precautions against extraneous electricity; misfires and deteriorated explosives safety and legislation for storage; transportation and handling of explosives.

KCME1105
Slope Stability for Surface Mining
Staff Contact: Key Centre for Mines
CP12

This comprehensive course will deal with the major topics of engineering geology and groundwater controls, in the form of discontinuities, variable materials and pore pressures. Effect of excavation method and scheduling in pit stability. The fundamental basis of stability analysis, advantages and disadvantages of a range of mathematical models, remedial measures that can be taken to stabilise slopes. Pit slope design in the context of overall mine planning. In addition to dealing with the underlying principles, the subject may involve workshops and field inspections so that the participants gain hands-on experience of practical cases.

KCME1106
Soil and Rock Construction Materials
Staff Contact: Mr G H McNally
CP12

This course provides an introduction to the location, assessment, mining and processing of soil and rock construction materials and to the environmental problems associated with their extraction. The main themes explored include the maximum use of existing quarries, the use of upgraded marginal materials and the reclamation of quarried lands. The materials covered include aggregates, ballast, armour-stone and prepared road base, sand, gravel and natural pavement materials, artificial aggregates and stabilised road base, brick clay, limestone and cementitious materials.

KCME1107
Introductory Computing and Statistics for Geologists and Mining Engineers
Staff Contact: Dr DR Cohen
CP12

Introduction to the use of PCs, operating systems, communications and networks, common software packages. An introduction to programming, spreadsheets, graphics software and the SYSTAT package. Fundamentals of statistics including types of data, population characterisation, tests of significance, analysis of variance and basic geostatistical methods.

KCME1108
Applied Structural Geology
Staff Contact: Dr PG Lennox
CP12

Introduction to stereographic projection techniques as applied during structural analysis. Integration of mesoscopic folding, foliations and lineations to development of three dimensional models of the geology. Case studies of hydrocarbon plays, mineral deposits and coal mines. Understanding failure in rocks using the Mohr Failure Envelope. The geometry of normal, thrust and strike-slip faults and resulting structural assemblages. Construction and assumptions underlying drawing balanced cross-sections. Regional structural control of mineralisation. Fundamentals, strategies and techniques of structural analysis of cores. Field techniques for structural analysis of cores. Field techniques for structural analysis in multiply deformed terranes and its application in a base metal mine.

KCME1110
Geographical Information Systems in Applied Geology
Staff Contact: A/Prof GRTaylor
CP12

Introduction to GIS; raster versus vector systems; overview of GIS in geology and geological applications of GIS. Introduction to raster systems; spatial associations and analysis tools; digital terrain modelling; spatial modelling - site and route selection. Introduction to vector systems; vector data models and data base systems. Input of spatial data into vector based GIS; building a vector geographical data base. Managing attribute data; data analysis and modelling using a vector based GIS. Cartographic output and data display; TIN and network. Spatial data analysis methods in geology; geological case studies; integration of GIS and Remote Sensing. GIS hardware, GIS organisational and management issues.

KCME1300
Mining Management Project
Staff Contact: A/Prof GRTaylor
CP48

A study of either an administrative or technical nature with relevance to the management of a mining or mineral processing operation. This may be based on simulated or actual situations but projects of relevance to the candidates employment will be encouraged. As far as is possible projects will be designed in consultation with the mining industry.

KCME1302
Mine Ventilation and Environment
Staff Contact: Mr VS Vutukuri
CP12

The course includes the following topics: ventilation network analysis and simulation; fan selection; role of booster fans; ventilation of long headings; recirculation; gases from diesel engines and their control; methane and its control in underground coal mines; dust in mine air and its control; mine climate and its control; ventilation planning.

Subject to be delivered as a short course consisting of 35 hours of class contact and additional tutorials equivalent to a further 7 hours of class contact.

KCME1400
Mining Management Project
Staff Contact: Dr MB Katz
CP36

A study of either an administrative or technical nature with relevance to the management of a mining or mineral processing operation. This may be based on simulated or actual situations but projects of relevance to the candidate's employment will be encouraged. As far as possible, projects will be designed in consultation with the mining industry.

KCME2101
Strata Control
Staff Contact: Key Centre for Mines Office
CP12

This course presents to the practising engineer the latest developments in the field of strata mechanics and develops a sound design background to enable the carrying out of efficient mining operations for increased productivity consistent with safety. The course covers the fundamentals of strata mechanics together with advanced topics including engineering technology and rock mechanics aspects of coal mining strata control. Emphasis will be given to the various design aspects of mine structures, such as mine pillars, gate roads and long wall mining. The role played by instrumentation in providing for the safe design of the mine opening will be addressed. Special sessions will be devoted to rock and cable bolting techniques and powered support design.

KCME2104
Application of Computers in the Mineral Industry
Staff Contact: Key Centre for Mines Office
CP12

Geostatistical ore reserve estimation on a personal computer; computerised open pit design and planning; mine system simulation using GPSS/PC An expert system for the mineral industry. Mine ventilation planning on a personal computer, using Lotus 123 spreadsheet to solve mining problems.

KCME2105
Geostatistics and Ore Body Modelling
Staff Contact: Key Centre for Mines Office
CP12

When to apply geostatistics; brief review of univariate statistics; bivariate statistics and correlation; exploratory data analysis; measures of spatial correlation: the variogram, the covariance; variogram calculation and how to obtain a good variogram; random function models and stationarity; desirable properties of estimators; estimation of variance; dispersion variance and uses; optimal weighted average estimator, ordinary kriging; recoverable reserve estimation, problems and solutions; application examples, coal, copper, gold; blasthole kriging for orewaste selection; geotechnics and the environment.

KCME2107
Mine Water Origin, Inflow, Prediction and Control
Staff Contact: Key Centre for Mines Office
CP12
Note/s: This is a short course subject and can be done by correspondence.

This course investigates the origin of mine water, and hydrological and hydrogeological factors affecting mine drainage. The method of predicting mine water inflow and techniques of mine water control will be considered. Pumping tests, surface stability, inflow and calculations of water inflow in open cut operations are studied. Underground mine dewatering techniques, pumps, and pumping systems, mine inundation as well as methods for mine water pollution control and treatment are compared.

KCME3101
Coal Preparation
Staff Contact: Dr AC Partridge
CP12

Coal characterisation, principles of separation, materials handling, sampling - theory, sampling - equipment and practice, screening and communition, cleaning of coarse and small coal, water based separation, dense medium separation, cleaning of fine coal, solid liquid separation theory, cyclones, vacuum and pressure filtration, centrifuges(product and tailing), clarification/thickening practice, pumping, piping, valving, plant design, layout and upgrading, maintenance, control concepts (basic process control), on-stream analysis, overall plant control and optimisation.

KCME3201
Financial Management
Staff Contact: Key Centre for Mines Office
CP12
Note/s: Offered by correspondence.

The course covers the following topics: financial management, an overview; accounting concepts and the accounting process; financial statements; public sector accounting; corporate accounting; the interpretation of financial statements; the recording of costs; management cost information (1); management cost information (2); the budgeting process.

KCME3202
Management Perspectives
Staff Contact: Key Centre for Mines Office
CP12
Note/s: Offered by correspondence.

The course covers the following topics: what is management?; managing individuals; managing groups; managing organisations; managing information; managing operations; managing decision making.

KCME3203
Economic Decision Making
Staff Contact: Key Centre for Mines Office
CP12
Note/s: Offered by correspondence.

The course covers the following topics: introduction to economic concepts demand; supply and the market consumers; firms and market structures; welfare economics and government intervention; international economics; macroeconomics and national income analysis; national economic policy benefit cost analysis and expenditure decisions; business finance.

KCME3204
Management of Innovation
Staff Contact: Key Centre for Mines Office
CP12
Note/s: Offered by correspondence.

The course covers the following topics: innovation and innovators; technology and innovation; opportunity analysis; marketing and innovation; the business plan; management of innovation; innovations in corporations; maintaining innovations.

KCME3205
Strategic Planning
Staff Contact: Key Centre for Mines Office
CP12
Note/s: Offered by correspondence.

The course covers the following topics: the nature and scope of strategic management; the practice of strategic management; the mission of the organisation; analysing organisational resources; formulating strategic objectives; generating strategic alternatives; evaluating strategic alternatives; strategic implementation; assessing strategic performance.

KCME3206
Mining Law
Staff Contact: Key Centre for Mines Office
CP12

Topics to be covered with course include: definitions of 'minerals'; common law; ownership; Aboriginal land rights; miners' rights and claims; exploration titles; production titles; private land/Crown land; administrative processes; environmental protection and royalties. These topics will be illustrated by reference to a number of case histories.

KCME4102
Placer Technology
Staff Contact: Key Centre for Mines Office
CP12

Sources of placer minerals; natural processes producing concentration of placer minerals; nature of placer deposits; trends in placer exploration; placer sampling; reserves calculations; mining methods; processing methods; project evaluation; environmental implications and pollution control technology.

KCME4133
An Introduction to Environmental Geology
Staff Contact: Key Centre for Mines Office
CP12

Geological hazards: seismic risk, landslides, subsidence, floods, erosion, volcanic eruptions, discrete and continuous hazards, event return time. Geological resources and their management: types of resources, use and potential environmental conflict, resource economics and policy formulation. Waste disposal and the mineral industry, reclamation and rehabilitation of land used for extractive purposes. Swamp drainage. Geology and urban planning: map preparation, multiple land use principle, aesthetic criteria for landscape evaluation. Environmental impact of dams, roads, explorative land extractive stages of mining, impact statement techniques, case studies. Communication of geological information to technical and non-technical people. Geological legislation for water resources and waste disposal.

KCME4201
Export Marketing for the Mining Industry
Staff Contact: Ms J Morgan
CP12

Marketing as applied to the mineral industry. Sources and types of market-related information. Particular international market characteristics; political, social and economic. Trade barriers, cartels, regional and subregional economic groupings. Marketing to Asia. Buyer behaviour, private and government sectors. Design, conduct and analysis of surveys of overseas markets for mineral products. Factors related to particular mineral commodities. The recognition of export opportunities. Stages in the development of a market strategy. Market decision making under conditions of uncertainty. The relationship between corporate and marketing strategy for mineral products. Value added mineral products and export marketing. Sources of assistance for export marketing.

KCME4202
Mine and Project Evaluation
Staff Contact: Mr EJ Malone
CP12

Topics to be covered in the course include: introduction to accounting, understanding financial statements, financial theory in relation to project evaluation, evaluation techniques, project financing, cost of capital, revenue assumptions, cost assumptions, risk analysis and responses to uncertainty, project optimisation, feasibility studies, institutional and corporate perspectives on project evaluation, introduction to financial modelling, review of cases for financial modelling, practical exercises in financial modelling, intra-project evaluation, comprehensive financial model case study, valuation reports and published assessments. Coal industry topics: coal qualities, marketing and economics. Mineral industry topics: significance of technical inputs; preliminary investigations and asset determinations, and underground base metal development study.

KCME4203
Mine Management
Staff Contact: Mr SG Gemell
CP12

The subject covers general management functions, planning, organisation, control, communication, command, coordination, production functions, marketing, financial aspects, personnel, purchasing, public relations, environmental matters, contracts and stock market requirements and implications.

KCME4204
Mineral Exploration Project Management
Staff Contact: Mr EJ Malone
CP12

This course stresses the need to define the exploration target in order to design appropriate exploration programs and establish criteria for monitoring the effectiveness of the programs. Exploration techniques are reviewed with emphasis on the applicability of specific techniques in particular circumstances, their limitations and the use of orientation work to establish performance criteria. Specific topics include: introduction to program design; review of available techniques; remote sensing techniques; geochemical techniques; airborne geophysical surveys; ground geophysical surveys; data interpretation; reporting

and supervision; sequential exploration; definition of drill targets; budgeting and budget management.

KCME4301
Environmental Management for the Mining Industry
Staff Contact: Key Centre for Mines Office
CP12
Note/s: May be taken as either a Science and Technology or a Business Management Module.

Topics addressed are: environmental regulation as a constraint on business operations; environmental planning and management as a component of overall business planning; financial costs and benefits of environmental management and their timing; environmental risks and uncertainty; integrated design strategies; emission control technologies; formal environmental impact assessment procedures, including public submissions and hearings; lease and licence conditions; compliance with planning and pollution control legislation; developing and using environmental operations manuals; in-house environmental training progams; corporate environmental audit procedures; liaison with public and community groups; particular EPM applications in mining, oil, manufacturing, petrochemical, civil engineering and infrastructure, building and construction; coastal management and other industries; EPM issues and concerns in Asia-Pacific nations and the region as a whole. Subject to be delivered as a short course consisting of 35 hours of class contact and additional tutorials equivalent to a further 7 hours of class contact.

KCME 4302
Environmental Assessments
Staff Contact: Dr D R Cohen
CP12

This course is an introduction to methods for assessing existing and potential contamination of industrial sites and mining operations. The course includes elements such as the policy and legal framework of environmental assessments; sources of information on a range of chemical contaminants and recommended exposure limits; the role of the assessor (or auditor). Selected environmental assessment case studies will be considered.

KCME 4303
Mine Geology and Grade Control
Staff Contact: Mr EJ Malone
CP12

Sampling theory and sampling techniques relevant to various styles of ore bodies, mining methods and scales of mining; statistical and geostatistical techniques for verifying and manipulating sample analytical data; reserves modelling; grade interpolation; fundamental grade control problems; case histories; computer modelling demonstrations; practical exercises.

MINE0010
Applied Mechanics
Staff Contact: Dr JO Watson
CP7.5 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.

MINE0014
Exploration Drilling
Staff Contact: Key Centre for Mines Office
CP12 S1 or S2 HPW3

Drilling equipment and technology. Deep boring. Selection of drilling methods, drill hole surveys. Development and exploitation of mineral resources. Exercises on mine planning.

MINE0110
Stress Analysis 1
Staff Contact: Dr JO Watson
CP7.5 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. Mohr's circle of stress; definition of strain in three dimensions; strain-displacement relations in two dimensions; Mohr's 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
CP7.5 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 FF Roxborough
CP8 S1 LI2

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 FF Roxborough
CP2.5 S2 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.

MINE0410
Technical Communication
Staff Contact: Dr CR Daly
CP5 S2 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
CP5 S2 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.

MINE1114
Mining Engineering
Staff Contact: Dr VS Vutukuri
CP24 F HPW3

1. Surveying methods to quantify mineral resources. Mine development. Explosives. Shaft sinking, tunnelling, excavation methods. 2. Advanced mining systems, parameters for applicability and efficiency of mining methods, waste disposal. Non-entry methods, in situ mining. Offshore mining methods. Rock mechanics, mechanical behaviour of rocks. The Mining Acts.

MINE1131
Mining of Metalliferous Deposits
Staff Contact: Mr D Panich
CP7.5 S1 L3
Prerequisites: MINE0210, MINE1420, GEOL5211

Geology, mineralogy and physical characteristics of a mineral deposit. Mineralisation inventory: maps and sections. Determination of reserves. Choice between surface and underground mining: selection criteria. Mining methods in surface and underground operations. Mining sequence. Production planning and scheduling. Equipment selection: systems approach; types of equipment; selection 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: Prof JM Galvin
CP7.5 S1 L3
Prerequisites: MINE0210, MINE1420, GEOL5211

Geological factors, physical and mechanical characteristics of the seam, roof and floor. Maps and sections. Determination of reserves. Choice between surface and underground mining methods: selection criteria. Mining methods for surface and underground operations. Impact of surface constraints. Production planning and scheduling. Mining geometrics. Stability and support. Equipment selection: systems approach; types of equipment; selection of type, capacity and number. Mining and ancillary operations. Productivity and operating costs. Health and safety. Communications and control. Rehabilitation.

MINE1140
Geotechnical Engineering
Staff Contact: Dr VS Vutukuri
CP10 F L1 T1
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.

MINE1224
Mining Engineering Technology
Staff Contact: Dr VS Vutukuri
CP24 F HPW3

1. Mine ventilation contaminants, toxicity of mineral particles and gases, thermodynamics of mine air, network analyses, air conditioning in mines. Mine safety, health, hygiene, noise. **2.** Mine lighting, electrical power distribution, generation and reticulation of compressed air. Materials handling. Surface and underground haulage systems, design criteria. Mine drainage. Standards specifications. **3.** Feasibility studies. Mine design and layout, separation of functions for maximum efficiency; application of analogue and digital computers. Production control, grade control, administration. Resources allocation, finance, labour, equipment. Size and scope of mining company operations. **4.** Mine support. Mining methods employing fill, fill compressibility. Rock and cemented rock fill. Placement of mixed fills. **5.** Rock mechanics. Stress and strain analysis. The mechanics of strata movement and the distribution of pressure around mine workings. Ground control and methods of support in the workings and the waste. Design of mining excavations. Slope stability. **6.** Subsidence phenomena associated with mine workings. Methods of working and design of structures to minimise damage.

MINE1231
Rock Mechanics
Staff Contact: Dr VS Vutukuri
CP10 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
CP5 S2 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
CP7.5 F L1 T5
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.

MINE1321
Mine Water and Drainage
Staff Contact: Dr VS Vutukuri
CP2.5 S2 L1
Corequisite: MINE1320

Engineering hydrology, sources of mine water, forecasting water inflows, drainage.

MINE1324
Mining Engineering Laboratory
Staff Contact: Dr VS Vutukuri
CP32 F HPW4

A selection of advanced laboratory investigations in sampling and valuation, mine support, temporary or long term; mine design and plant related to extraction and servicing functions; rock properties; programming of mining methods and transport; non-entry mining; petroleum engineering; gasification; solvent processes.

MINE1330
Bulk Materials Handling and Transport
Staff Contact: A/Prof GC Sen
CP5 S2 L1.5 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.

MINE1420
Elements of Mining
Staff Contact: A/Prof GC Sen
CP6 S1 L1
Prerequisite: MINE0210
Note/s: Visits to mines and related undertakings are a requirement of this subject.

Exploration. Development of mines, infrastructure requirements; environmental assessment. Ore body parameters for surface and underground mines; stratified and non-stratified deposits; mine layout for surface and underground operations; underground access; introduction of techniques of rock breakage and support for coal and metal mines; processing of minerals; disposal of overburden and rejects rehabilitation.

MINE1514
Ground Control and Excavation Engineering
Staff Contact: Dr VS Vutukuri
CP12 FHPW3

1. Natural state of stress in rock masses. Effects of geological structures on the stability of mine working. Stresses and rock movements induced by mining operations. Design of mining systems and layout of workings based upon rock mechanics and functional considerations. **2.** Principles and design of support systems. Inter-relation of temporary, stabilising and long term support. Support of permanent mining and civil engineering openings. Control of ground in the vicinity of production excavations. **3.** Design and construction aspects of open pit slopes and tailing dams. **4.** Rock-breaking and drilling methods, penetrability and workability of rocks; fracturing. Nature, occurrence and prediction of rockbursts. Mechanics of crack propagation and subsidence.

MINE1524
Mining Conservation
Staff Contact: Dr VS Vutukuri
CP12 S1 or S2 L2 T2

The reclamation of excavated land; integration with operational stages of mining. Mining cycles of alluvial, strip, and open cuts, land clearing, stabilising the mined area, socio-economic aspects of mining, rehabilitation costs, government regulations. Examination and evaluation of a current operation.

MINE1530
Power Supply in Mines
Staff Contact: Dr CR Daly
CP5 S1 L1 T1
Prerequisites: MINE0310, MINE1320, PHYS2920, ELEC0802

Electric power distribution, mine cables, switchgear. Flame-proofing and intrinsic safety, fault protection, risk analysis. Oil hydraulic power. Components and circuits. Pumps, motors, valves.

MINE1534
Environmental Conditions in Mines
Staff Contact: Dr VS Vutukuri
CP12 S1 or S2 HPW3

The energy equation applied to ventilation, sources of heat in mines, geothermal gradients, thermodynamics, pressure-volume diagrams. Practical aspects of high air temperatures and the control of atmospheric conditions in deep underground mines. Fan design, installation and testing. Psychrometry, ventilation planning. Computer applications. Selected laboratory experiments and network designs.

MINE1544
Rock Excavation and Transportation
Staff Contact: Dr VS Vutukuri
CP12 S1 or S2 HPW3

Rock fragmentation drilling, blasting large rounds. Loading techniques, shovels, draglines, bucket wheel excavators, dredges, front-end loaders, tractor scrapers. Operating factors, selection procedures, cost estimating. Materials handling, continuous, semi continuous, batch systems, cost analysis.

MINE1630
Excavation Engineering (Blasting)
Staff Contact: A/Prof GC Sen
CP5 S1 L2

Percussive, rotary and hydraulic rock drilling equipment: applications and operating principles, maintenance. Drilling methods: in-the-hole hammer, diamond core, overburden, Odex. Theories of rock fragmentation by blasting. Types of explosives and their properties. Various initiation systems. Blasting accessories and their applications. Blast design in various underground and surface mining operations. Blasting hazards and precautionary measures. Protection of structures against blast induced ground vibrations and airblast. Alternatives to conventional explosives.

MINE1631
Excavation Engineering (Machine Mining)
Staff Contact: Prof FF Roxborough
CP2.5 S2 L1

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
CP5 S2 L2

An appreciation of the laws relating to coal and metal mining practice and to safety and health in mines.

MINE1830
Mine Ventilation and Environment
Staff Contact: Dr VS Vutukuri
CP10 S2 L2 T2
Prerequisites: MINE0210, MINE1420, 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 AC Partridge
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: A/Prof GC Sen
CP5 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: Mr D Panich
CP5 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: Mr D Panich
CP15 F L1 T2
Prerequisites: MINE1131, MINE1132
Corequisite: MINE2141

Interpretation of exploration data. Sampling. Estimation of resource and reserves: traditional and geostatistical methods. Mine planning parameters. Mine design. Equipment selection. Productivity. Capital and operating costs. Mine design project.

MINE2240
Mining Management
Staff Contact: Dr CR Daly
CP7.5 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: Dr VS Vutukuri
CP7.5 S2 L1.5 T1.5
Prerequisites: MINE 0210, MINE1420

Outburst in coal mines: occurrence, prediction and control. Mine explosions and their control methane, coal dust, sulphide dust. Mine fires and their control open fires, spontaneous combustion of coal and sulphide ores in underground mines, sealing off fires underground, fire fighting, recovery of sealed-off areas. Water in mines: inundations, inrushes, precautions. Radiation in mines: hazards, dosage, radon gas emission and sources, control of radiation. Safety in mines: accidents; types, causes, rates, prevention. Breathing apparatus; types, uses, physiological requirements. Emergency organisation and rescue work. Miners' diseases; prevention and treatment. Noise and its control in mines; properties of vibrations, measurement of sound, effects, sources, control. Illumination in mines; properties of light, light sources, illumination in underground and open cut mines, standards for mine lighting, photometry, design of lighting systems. Laboratory experiments.

MINE3041
Hazard and Risk in Mining
Staff Contact: Prof J Cross
CP5 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.

MINE3101
Mineral Process Engineering C
Staff Contact: Dr AC Partridge
CP10 F L1 T1

The necessity for mineral beneficiation. Mineralogical assessment. Comminution, fracture, liberation, size criteria, energy-size relationships, crushing and grinding. Screening and classifying. Fluid dynamics and suspensions. Attrition. Concentration processes: density, electrical, magnetic and other physical methods. Interfacial phenomena. Surfactants. Flotation. Liquid-solid separation: flocculation, thickening, agglomeration, filtration. Materials balances. Laboratory exercises in mineral engineering.

MINE3114
Mineral Beneficiation
Staff Contact: Dr AC Partridge
CP12 S1 or S2 HPW3
Prerequisite: MINE7341 or equivalent

Processing economics: mineral processing and its integration with mining, metallurgical and chemical operations. Principles of roasting, leaching, electrolysis, cementation, solvent extraction and ion exchange. *Particle mechanics:* size, shape, surface area, size distribution functions. Relative and bulk densities. Theory of fracture mechanisms, comminution, energy requirements. Processes of agglomeration. Physical separation methods, electronic sorting, electrostatic and magnetic separation.

MINE3140
Computational Methods in Geomechanics
Staff Contact: Dr JO Watson
CP5 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 Poisson's 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 Poisson's 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.

MINE3224
Mineral Beneficiation Technology
Staff Contact: Dr AC Partridge
CP24 F HPW4
Prerequisite: MINE3114 or equivalent

1. Fluid mechanics of mineral pulps, free, hindered and zone settling, thickening, classification, hydrocyclones, dewatering, filtration. Gravity concentration jigging, sink and float, flowing film fluidized beds. **2.** Interfacial phenomena, the structure of solid-water, air-water, solid-air and oil-water interfaces. Experimental techniques, applicable to the study of these interfaces. Electrokinetic theory, electrical double layer interaction. Adsorption mechanisms. Collectors, activators, depressants,

modifiers, frothers, flocculants. **3.** Sulphide mineral flotation, xanthate chemistry, oxide mineral flotation, salt mineral flotation. Coal preparation, coal constitution, bore core evaluation, selective preparation, blending for utilisation. **4.** Process design. Feasibility studies, extraction processes and environmental conditions. Selection and location of equipment, fluid-solids flow, design of auxiliary units, development and presentation of flowsheets. Sampling and experimental techniques, batch, continuous and pilot plant testing. Scale up. Product disposal. Principles of chemical analysis, instrumentation, measurement of variables in mineral processing, controllers, use of computers. Technical management.

MINE3240
Operations Research
Staff Contact: Dr CR Daly
CP5 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.

MINE3324
Mineral Engineering Laboratory
Staff Contact: Dr AC Partridge
CP32 S1 or S2 HPW3
Prerequisite: MINE3114 or equivalent

Laboratory investigations may be selected from the following according to availability and specialisation: metalliferous ore concentration; coal preparation; beneficiation of non-metallics; processing of mineral fluids.

MINE3514
Mineral Beneficiation Plant Design
Staff Contact: Dr AC Partridge
CP12 S1 or S2 HPW3
Prerequisite: MINE7342 or MINE3114 or their equivalent

Process design based upon mineral properties; extraction processes and environmental conditions. Selection of technology to be adopted. Basis of feasibility studies. Special considerations for coal preparation and treatment of industrial minerals. Flowsheet planning, solid and fluid flows, auxiliary units, materials handling, product disposal. Experimental techniques used in testing. Scale up procedures. Plant control, automation, use of computers. Management of mineral processing operations.

MINE3614
Minerals Engineering 1
Staff Contact: Dr AC Partridge
CP24 S1 L3 T4

1. Principles of mineral deposition. Constitution of coal. Fuel technology. Coke making. Principles of extractive metallurgy. Beneficiation and utilisation of industrial minerals. Materials balances. **2.** Fluid dynamics of mineral pulps. Rheology of fluids and particulate suspensions. Dynamics of particle and bubble motion and collision. Flow through porous media. Fluidized beds. Flow in pipes, open channels and thin films. **3.** Materials handling: Flow characteristics of granular materials. Belt and mechanical conveyors. Stockpiles, bins and hoppers. Blending. Feeders. Distributors. Slurry pumps. Solids pipelines. Sampling theory and practice. **4.** Particle statistics: Concepts of particle size. Size analysis methods. Size distribution functions. Specific surface. Shape factors. Number, Surface and Volume mean sizes. **5.** Interfacial phenomena: Free surface energy. Surface tension. Three phase contact. Electrokinetic theory. Double layer interaction. Chemical and physical adsorption. Experimental techniques. Foams.

MINE3624
Minerals Engineering 2
Staff Contact: Dr AC Partridge
CP24 S1 L4 T4

1. *Comminution.* Fracture. Liberation. Energy-size relationships. Grindability. Conventional comminution equipment. Feed and product characteristics. Open and closed circuit operation. Vibratory and fluid energy mills. **2.** *Screening and classification.* Screening as a process of chance. Screen loading. Factors affecting screen capacities. Types of screen. Probability screens. Optical imaging. Hydraulic, mechanical and cyclone classifiers. **3.** *Physical concentration processes.* Gravity concentration. Jigs, heavy media and flowing films. Electronic and optical sorting. Electrical and magnetic separators. **4.** *Chemical concentration processes.* Leaching. Solvent extraction and ion exchange. Cementation. Cyanidation and amalgamation. **5.** *Flotation.* Collectors, activators, depressants, modifiers, frothers. Conventional and novel cells. Flotation kinetics. Entrainment. Soluble salt flotation. Reverse flotation. Agglomeration and carrier flotation. Selective flocculation and agglomeration. **6.** *Liquid-solid separation and product disposal.* Flocculation. Thickening. Filtration. Drainage. Dewatering by screens and cyclones. Centrifuging. Dryers. Tailings dams. Tailing utilisation including mine fill, reclamation. Pollution control.

MINE3634
Minerals Engineering Laboratory
Staff Contact: Dr AC Partridge
CP12 S1 T3

A series of laboratory investigations relating to material covered in subjects MINE3614 and MINE3624

MINE3644
Minerals Engineering 3
Staff Contact: Dr AC Partridge
CP24 S2 L4 T4

1. *Process analysis and simulation.* Partition and efficiency curves. Washability curves. The Mayer curve. Computer models of comminution, sizing and concentration processes. Laboratory and pilot scale testing. Scale up procedures. **2.** *Process design.* Process appraisal, selection of technology based upon mineral properties, extraction processes, energy requirements and environmental conditions. Feasibility studies. Special considerations for coal preparation and treatment of industrial minerals. Process flowsheet planning, equipment selection and details of solid and fluid flows. Engineering flowsheets showing details of major and auxiliary units, materials handling, product disposal, water and electricity, distribution and equipment control. **3.** *Instrumentation and control.* Principles of chemical analysis. Laboratory and *in situ* instrumental analysis. Flow and density gauges. Level detectors. Belt weighers. Controllers and control strategies. Automation. **4.** *Plant design.* Factors influencing selection of site. Plant and site layout. Preparation of technical and commercial specifications and tender documents. Construction scheduling. Environmental aspects. Noise control. Safety. **5.** *Management.* Personnel selection and

training. Trade Union organisation. Communications and consultation. Management structure and organisation. Marketing. Contracts and smelter schedules. Maintenance planning. Accounting and budget control. Purchasing and stores policies.

MINE3654
Minerals Engineering Project
Staff Contact: Dr AC Partridge
CP36 F HPW4.5

Laboratory work to evaluate information necessary for the design of a process for the beneficiation of ore from a metalliferous deposit, preparation of coal or treatment of industrial minerals. Candidate's report to include a process flowsheet, an equipment and materials flowsheet and a plant design layout.

MINE4055
Numerical Methods in Geomechanics
Staff Contact: Dr JO Watson
CP12 S1 or S2 HPW3

Boundary Value Problems: Equivalent continuum, equilibrium in terms of stresses, boundary conditions, displacement and strain, constitutive relations of elasticity, differential equations. *Finite Elements:* Approximate solution and variational principle, stiffness matrix and equivalent nodal force vector, finite elements, assembly and solution of the global system, isoparametric and infinite elements, pre and post-processing, elastoplasticity, groundwater flow, modelling strategy, programming considerations. Geotechnical applications. *Boundary Elements:* Basic singular solution, indirect method, direct method, isoparametric and infinite elements, construction and solution of system of equations, programming considerations, geotechnical applications.

MINE4101
Mineral Processing Practices
Staff Contact: Dr AC Partridge
CP5 S1 L2
Prerequisites: MINE3101

Physics and chemistry of surfaces. Measurement of surface properties. On-stream and laboratory analysis and measurements. Laboratory and pilot testing. Flowsheet design. Equipment selection. Plant layout. Monitoring and control systems. Process evaluation. Storage and blending. Materials handling. Waste disposal and pollution control. Waste treatment. Process simulation. Marketing.

MINE4140
Minerals Industry Project
Staff Contact: Dr AC Partridge
CP20 F T4

Candidates are required to submit a dissertation or thesis on a mining, minerals engineering or other topic approved by the Head of Department. 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.

MINE4155
Stability of Slopes
Staff Contact: Prof J M Galvin
CP12 S1 or S2 HPW3

Data collection for pit slope design, statistics of defects in rock masses: Length, orientation, spacing, roughness, planar and two wedge failure modes. Tetrahedral wedges, Bishop, Morgenstern-Price and other methods. Physical admissibility. Toppling and other modes of failure, probabilistic slope analysis, effect of persistence, bench and overall slope design. Slope support; cable bolts, anchors and other methods, drainage for improvement of stability. Dams and tailings disposal. Slope monitoring. Continuum and joint seepage of water.

MINE4240
Industrial and Research Seminars
Staff Contact: Prof FF Roxborough
CP5 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.

MINE4401
Mine Waste Disposal and Environment
Staff Contact: Dr AC Partridge
CP5 S2 L2

Environmental legislation. Mine waste management, land use relating to the disposal of mine wastes. Construction, maintenance and safety of tailings dams and spoil tips. Groundwater considerations. Spontaneous combustion. Retreatment of mine washes. Rehabilitation and revegetation of waste areas.

MINE4424
Mineral Industry Analysis
Staff Contact: Dr VS Vutukuri
CP10 S1 or S2 L2 T2

Aspects of micro and macroeconomics. Type of companies, private, public, noliability, State ownership and participation. Financing of mining ventures. Contracts and project assessment. Obsolescence and replacement. Operations research control networks, decision analysis, linear programming, queueing theory, simulation, improvisation. Grade control, estimation of cutoff grades. Includes advanced work in the technical and economic analysis of mining or mineral operators. Cases are selected for examination and analysis; critical review.

MINE4540
The Mining Engineering Profession in Society
Staff Contact: Dr JO Watson
CP5 S2 L1 T1
Prerequisite: APSE0002

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 'limited responsibility'. 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.

MINE4555
Mining Geomechanics Project
Staff Contact: Dr JO Watson
CP48 F HPW6

Individual project on an investigation related to an actual mining geomechanics problem, the topic to be chosen after consultation with a staff member. A report is required.

MINE5064
Minor Project
Staff Contact: Dr VS Vutukuri
CP24 F HPW3

This subject will comprise a literature-based review and a thesis presentation requiring interpretative skills. Experimental work is preferable but not essential. Projects may be based on mining, geology, mineral processing or engineering aspects of industrial processes.

MINE5124
Project
Staff Contact: Dr VS Vutukuri
CP48 F HPW6

A critical literature review and an experimental program or laboratory work to prove an hypothesis or produce a technical report at a professional level. The report must either be a conventional bound thesis or a combination of covered report, program disks and drawing suitable for permanent library storage. Projects may be based on mining, geology, mineral processing or engineering aspects of industrial processes.

MINE5155
Rock Mechanics Measurements
Staff Contact: Dr VS Vutukuri
CP12 S1 or S2 HPW3

Field measurement of rock mass properties. Controlled post-failure strength and deformation properties of rock. Data collection and analysis. *In situ* stress measurement. Prediction of pre-mining rock stresses. Monitoring rock movement and stress change in underground and surface rock excavations. Seismic techniques in rock mechanics.

MINE5184
Major Project
Staff Contact: Dr VS Vutukuri
CP72 F HPW9

As for MINE5124 Project, but this will comprise a critical literature review accompanied by a comprehensive experimental program of a substantial nature and an interpretative thesis. The candidate is encouraged to seek industrial support for the practical work.

MINE5255
Strata Control Engineering
Staff Contact: Dr VS Vutukuri
CP12 S1 or S2 HPW3

Dislocations, stress changes and energy changes in the rock mass around underground excavations. Design of self-supporting, artificially supported and caved underground excavations. Introduction to boundary element methods of stress analysis. Prediction and control of rockbursts and instantaneous outbursts in coal. Analogue modelling of pillar mining. Rock mechanics of longwalls.

MINE5324
Principles of Mining Engineering
Staff Contact: Dr VS Vutukuri
CP24 F L2 T1

Office, workshop, stores and materials handling layout for mines. Layout of shafts, declines and main drives for optimum mineral recovery. Review of underground mining techniques for coal and metalliferous mines with emphasis on cost control and efficient operation. Surface mining techniques, design and layout of haul roads and stripping benches. Dragline and shovel operation. Effect of ventilation requirements and drainage on mine layouts. Scheduling for equipment transfer, maintenance and installation (e.g. longwall face transfers, underground crusher stations, dragline overhaul). Computer software for mine and plant maintenance and management.

MINE5355
Mine Fill Technology
Staff Contact: Department Office
CP12 S1 or S2 HPW3

Fill properties and their assessment. Fill preparation, placement and dewatering. Field sampling and in situ testing. Mining methods employing fill. Pozzolanic fills. Dry fills and rock fills. Economic aspects of fill practice. Soil and rock mechanics aspects. Environmental aspects. Specific fill practice in mining coal and uranium.

MINE5455
Advanced Rock Cutting Technology
Staff Contact: Prof FF Roxborough
CP12 S1 or S2 HPW3

Mechanics of rock cutting by picks, discs, toothed roller cutters and button cutters. Machine applications. Tool materials and wear. Selection of cutting systems. Rock cuttability assessment. Rock cutting machine design for coal and competent rock. Case studies.

MINE5555
Blasting Technology
Staff Contact: A/Prof GC Sen
CP12 S1 or S2 HPW3

Historical development of commercial explosives. Description of various explosives and their compositions. Explosive properties. Initiation of explosives. Delay systems in firing. Explosive accessories. Handling explosives on site. Safety in firing blasts and precautions against extraneous electricity. Procedure in misfires. Rock blasting without drilling holes. Acquisition, storage and transport of explosives. Underwater blasting. Underwater vibrations from blasting. VCR blasting.

MINE5655
Rock Slope Stability
Staff Contact: Dr VS Vutukuri
CP8 S1 or S2 HPW2

Economic aspects in the design of rock slopes in open cut mines. Failure of rock slopes and controlling factors. Stability of temporary rock slopes. Probabilistic analysis.

MINE5755
Subsidence Engineering
Staff Contact: Dr VS Vutukuri
CP8 F HPW2

Trough subsidence resulting from the extraction of bedded mineral deposits. Parameters influencing subsidence. Subsidence-related phenomena causing damage to structures at or below the surface. Measurement and empirical prediction. Theories and modelling of subsidence. Control of subsidence.

MINE7342
Minerals Engineering Processes
Staff Contact: Dr AC Partridge
CP10 F L1 T1

Objectives of mineral processing and coal preparation. Mine-mill interface. Properties of minerals and ores. Sampling and evaluation. Comminution: fracture, liberation, size criteria, energy-size relationships. Crushing and grinding. Screening and classifying. Concentration processes: density and other physical methods. Dissolution processes. Interfacial phenomena. Flotation. Liquid-solid separation: flocculation, thickening, filtration. Washability curves. Partition curves. Material balances. Performance prediction. Laboratory exercises.

MINE7440
Mineral Process Technology
Staff Contact: Dr AC Partridge
CP5 S1 L1.5T5

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.

MINE9174
Fire and Explosion
Staff Contact: Dr VS Vutukuri
CP8 S1 or S2 L2

Chemistry and physics of combustion reactions; types of flames; deflagration and detonation; ignition; fire point; flammable limits. Industrial fuel-fired appliances; fire risks in buildings; fire fighting equipment; flame proofing; fire and explosive risks in chemical process industries; case studies. Use of appropriate standards and legislation. Fire research; insurance.

MINE9364
Equilibrium Concepts in Water Systems
Staff Contact: Dr VS Vutukuri
CP12 S1 or S2 HPW3

The application and limitations of chemical thermodynamics in water systems. Aqueous inorganic process systems including water treatment and minerals processing. The effects and control of pollution. Thermodynamic diagrams such as lnE pH, potential pH, temperature pH and concentration pH are developed as an aid to assessing system energetics. Sources and estimation of thermodynamic data. Kinetics and mechanism in relation to aqueous system energetics. Analysis of kinetic data.

MINE9415
Advanced Rock Mechanics
Staff Contact: Dr VS Vutukuri
CP12 S1 or S2 HPW3

Field measurement of rock mass properties. Controlled post-failure strength and deformation properties of rock. Data collection and analysis of rock mass and support response. In situ stress measurement. Prediction of pre and post-mining rock stresses and deformations. Monitoring rock movement and stress change in underground and surface rock excavations. Seismic techniques in rock mechanics. Dislocations, stress changes and energy changes in the rock mass around underground excavations.

Centre for Petroleum Engineering

Director:
Professor WV Pinczewski

This Centre is an autonomous unit within the Faculty of Applied Science. Petroleum Engineering is a specialised engineering discipline which prepares graduates for a career in the oil and natural gas industries and its related operations applying 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 earth's surface.

The Centre for Petroleum Engineering differs from other Centres as it is responsible for its own degrees and therefore functions as an autonomous Department. It offers both undergraduate and postgraduate research degrees as well as a formal graduate diploma.

The Centre has a four-year course leading to the award of a Bachelor of Engineering in Petroleum Engineering.

Entry is normally into Year 1 of the program. The first two years of the Petroleum Engineering Course are essentially identical to the first two years of the Chemical Engineering Course. 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, in other assignments as directed by the Director of the Centre, and in the final year project, for which a thesis is required.

Because the first two years of the Petroleum Engineering course are identical to the first two years of the Chemical Engineering course, it is possible, upon completion of the Petroleum Engineering program, to obtain a double BE degree in Petroleum and Chemical Engineering with one additional year of study.

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
CHEM2828	Organic and Inorganic Chemistry (for Chemical Engineers)	4	0	10
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	1	2	7.5
ELEC0807	Electrical Engineering1E	0	3	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	**25**			
Total HPW Session 2	**25**			
Total Credit Points	**135.5**			
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
GEOL5301	Introduction to Petroleum Geology	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 I	0	3	7.5
Total HPW Session 1	**23**			
Total HPW Session 2	**24**			
Total Credit Points	**130**			
Year 4				
CHEN4030	Safety and Environmental	2	0	5
CHEN4070	Process Dynamics and Control	3	2	12.5
CHEN4080	Design Project	1	3	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
PTRL4010	Communication Skills for Engineers	2	0	5
Total HPW Session 1	**23**			
Total HPW Session 2	**20**			
Total Credit Points	**125**			

The Centre 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 Centre.

Graduate Study

Course Outline

5031
Petroleum Engineering Graduate Diploma Course

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 Centre, and in close co-operation 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 Centre for 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

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). The program also includes a workshop on log interpretation.

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: Prof AK Khurana
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 AK Khurana
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: Dr HA Salisch
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: Dr HA Salisch
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: Prof AK Khurana
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 for Engineers
Staff Contact: Dr HA Salisch
CP5 S2 L1

Interviews: preparation, appearance and attitude. Assessing and meeting company needs. Role of a junior engineer in a team environment. Impromptu and prepared presentation skills. Oil companies' expectations of engineering reports.

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.

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.

PTRL4018
Petroleum Economics 1
Staff Contact: Mr WG Allinson
CP5 S1 L2

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.

PTRL4028
Petroleum Economics 2
Staff Contact: Mr WG Allinson
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.

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. Constant terminal rate solution for the radial diffusivity equation. Constant terminal pressure solution for the 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 AK Khurana
CP5 S2 L2

Formulation of reservoir simulation equations. Explicit and implicit solution procedures. Cartesian and radial geometry. Single dimensional, two-phase flow. Description and use of commercial reservoir simulation software. Planning and execution of reservoir simulation projects. Effective 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: Prof AK Khurana
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

Need for economic reservoir analysis. Cash flow. Time value of money. Profitability of a venture. Valuation of oil and gas properties. Analysis of risk and uncertainty.

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 and blowout prevention equipment and methods. Special 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
CP20 S1 L2 S2 L2

A literature survey of a topic of relevance to the research effort of the Centre and of practical interest to the oil industry. To be submitted as an individual thesis. Topic must be approved by the Director of the Centre.

Department of Safety Science

Head of Department
Professor J Cross

Administrative Assistant
Mrs B Littlewood

Safety Science is a multidisciplinary activity concerned with the application of engineering principles and behavioural and health sciences knowledge to improve the health and safety of people at work and in their other activities. Safety Science considers the interface between people and technology and incorporates areas of study such as ergonomics, biomechanics, occupational disease, toxicology, educational psychology and engineering safety. The Department offers postgraduate courses leading to the award of the degrees of Master of Applied Science (Occupational Health Safety) **8044**,Master of Environmental Studies, **8045**, Master of Applied Science (Ergonomics) **8075**, Master of Engineering Science (Industrial Safety) **8545**, Master of Safety Science **8671**, Graduate Diploma in Safety Science **5480**, Graduate Diploma in Ergonomics **5485** and Graduate Diploma in Environmental Studies **5488**. There is also a qualifying course **6347**, which allows non-graduates with extensive appropriate work experience to enter the courses leading to a graduate diploma. There are no undergraduate courses in Safety Science but undergraduate students may take individual subjects from the graduate diploma and masters courses where these are appropriate to their undergraduate course or career. The Department is active in research in the areas of ergonomics, biomechanics, safety engineering, safety management, and occupational toxicology. Opportunities are available for graduate research leading to the degrees of Master of Science, **2775**, Master of Engineering, **2695**, and Doctor of Philosophy, **1665**.

Graduate Study

Course Outlines

8044
Master of Applied Science (Occupational Health and Safety)

MAppSc (OHS)

The Master of Applied Science in Occupational Health and Safety is a interdisciplinary rather than multidisciplinary course, and is designed to accept students from a range of backgrounds.

Admission to the Master of Applied Science in Occupational Health and Safety is available to candidates with a relevant degree of bachelor for four full-time years duration (or part-time equivalent) from the University of New South Wales or a qualification considered to be equivalent from another university or tertiary institution. Candidates with a three year degree may be admitted to the Masters program if they are able to demonstrate at least two years experience in a relevant area or may be admitted first to the Graduate Diploma of Safety Science but can upgrade to the Master of Applied Science in Occupational Health and Safety on satisfactory performance. Other candidates with extensive experience in a relevant area may also be admitted at the discretion of the Head of School.

The course will offered to students of the University of New South Wales either as internally registered students (by

attendance) or externally registered students (by open learning).

To provide for a common base of knowledge some students, depending on their background, are required to take some preliminary subjects. Most students with a health sciences background may be required to take SAFE9011 while those with a engineering background may be required to take ANAT6151. A knowledge of statistics is also a prerequisite for all students.

Candidates are required to complete a total of 144 credit points, made up of 48 credit points of core subjects,48 credit points of elective subjects and a 48 credit point research project.

Preliminary subjects
Students may be required to demonstrate either a satisfactory standard of understanding of all these preliminary subjects or to pass them in addition to the 36 credit points required to fulfil the requirements of the course.

		CP
ANAT6151	Introductory Functional Anatomy	7.5
SAFE9011	Physical Principles of Safety	12
SAFE9012	Statistics for Health and Safety Scientists	12

Core subjects
There are 48 credit points of core subjects required. Three core subjects are required to be taken by all students, the fourth core subject is dependent on subsequent areas of study.

SAFE9211	Introduction to Safety Engineering	12
SAFE9242	Effective Behaviour in Organisations	12
SAFE9260	Introduction to Occupational Health	12
and		
SAFE9261	Occupational Hygiene *or*	12
SAFE9262	Occupational Medicine *or*	12
SAFE9263	Chemical Safety and Toxicology *or*	15
SAFE9224	Principles of Ergonomics	12

Students leaving the course should have knowledge and competencies in a number of areas which are reflected in the choice of core subjects.

- occupational health and safety principles
- occupational health and safety legislation and standards
- the interaction between people, hazards, risks and behaviour
- ability to undertake simple workplace surveys in their chosen fields of expertise.

Elective Subjects
There are 48 credit points of elective subjects required. Students may structure their program so that they receive training as an occupational health and safety generalist, or they are able to specialise, taking electives in one of a number of strands, such as occupational hygiene, safety engineering, chemical safety, occupational medicine, ergonomics or safety management.

Subjects offered by the Department of Safety Science

Not all elective subjects are offered every year. Examples of such electives (most of twelve credit points) include:

SAFE9142	Organisational Communication for Safety
SAFE9224	Principles of Ergonomics
SAFE9232	Introduction to Occupational Health and Safety Law
SAFE9261	Occupational Hygiene
SAFE9262	Occupational Medicine
SAFE9263	Chemical Safety and Toxicology
SAFE9264	Assessment of the Workplace Environment
SAFE9265	Occupational Health Practice
SAFE9267	Research Methods in Laboratory Science
SAFE9272	Environment and Medicine
SAFE9273	Environment and Law
SAFE9342	Management for Safety
SAFE9343	Innovation, Productivity and Safety
SAFE9352	Hazard and Risk Analysis
SAFE9424	Applied Ergonomics
SAFE9425	Physical Ergonomics
SAFE9426	Ergonomics and New Technology
SAFE9523	Plant and Construction Safety
SAFE9531	Industrial and Environmental Noise
SAFE9533	Electrical Safety
SAFE9543	Management of Dangerous Materials
SAFE9544	Traffic Safety
SAFE9551	Experimental Biomechanics
SAFE9553	Radiation Protection
SAFE9573	Fire and Explosion

Subjects offered by other Departments
Students may also choose to take subjects offered by other Departments, subject to the approval of both the School concerned and the Course Coordinator. Examples of acceptable subjects in a study program in occupational health and safety include:

		CP
BIOM9541	Mechanics of the Human Body	12
CEIC5930	Safety in Laboratories	4
CIVL9872	Solid Waste Management	12
CIVL9881	Hazardous Waste Management	12
CMED9600	Disability	10
CMED9604	Tobacco, Alcohol and Other Drug Issues	10
CMED9609	Community Genetics	10
GEOG9230	Population, Health and the Environment	12
HEAL9411	Epidemiology	15
HEAL9421	Public Health	15
IROB5701	Australian Industrial Relations	20
LAWS5020	Industrial Safety and Health Law	15
MANF9400	Industrial Management	12
MANF9410	Total Quality Management	12
MEED9108	Program Evaluation and Planned Change	10
MEED9125	Planning, Conducting and Evaluating Educational Workshops	10

Project
Project students are required to undertake an investigative project and to present a satisfactory report. The project will normally be of 48 credit points value (SAFE9612). In special circumstances, for example when a student enters the course with substantial prior knowledge in the coursework, a superior Project Report of 72 credit points value (SAFE9618) may be permitted. Projects may be based on studies carried out at a student's place of work or in the laboratories of the Department or at any other place by arrangement with the Head of the Department. A range of instrumentation is available in the Department and liaison

can be arranged with industry if students do not have a suitable project at their place of work. Each student is required to present a progress report at regular seminars which all project students are expected to attend. Generally there are at least three such seminars in each session.

Shorter projects are also available in some circumstances.

		CP
SAFE9601	Report	4
SAFE9602	Report	8
SAFE9603	Report	12
SAFE9606	Report	24

8045
Master of Environmental Studies

MEnvStudies

This is a faculty-wide, interdisciplinary course, administered by the Department of Safety Science. The course draws from schools, departments, and centres throughout the University. The course covers a model of environmental studies as an interactive process of three overlapping headings:

- an understanding of natural systems and processes at global, regional and local levels, and the technical assessment and measurement tools for understanding them;
- an appreciation of how human activities impact on the environment (environment as a resource, environmental change, pollution, effects on health, recreational use of the environment) and the methodologies for examining this impact (environmental impact assessment techniques, systems approaches and so on);
- the social context of the environment and human responses to environmental issues (philosophy, ethics, values and ideology, economics, decision making, policy, environmental planning and management, law and politics).

The UNSW Masters Program in Environmental Studies is designed to provide students and graduates with:

- A conceptual framework for the study of environmental issues and problems, including:
- an understanding of natural systems and processes;
- an appreciation of how human activities impact on the environment;
- the ways in which these areas interact, including understanding of scientific, social, philosophical, economic, ethical, legislative and political concepts. Knowledge and skills in a range of environmental subject areas, including environmental assessment, environmental planning, environmentally oriented decision-making and the ways in which various disciplines may be integrated together.
- Experience in the design and conduct of projects in environmental studies.

The overall objective of the course is to provide opportunities for students to increase their skills in environmental management by extending their knowledge of environmental systems and processes. The course is one that has practical value which will help the careers of graduates.

The course is designed to study the nature of environmental problems and the methodology of evaluation. Emphasis is placed on the development of relevant skills in environmental analysis and planning.

Entry qualifications

The entry qualification for the Master of Environmental Studies degree is a four year honours degree or equivalent, in a field relevant to environmental studies. Applicants may also be admitted if they have a three year degree plus another qualification at an acceptable level, or have other professional or academic attainments. In the past, the course has attracted students from a wide variety of backgrounds, including those with first degrees in geography, biological sciences, geology, ecology, civil engineering, chemistry, physics, law, health administration, agriculture, social science and archaeology.

Course requirements

Students enrolled on the Master of Environmental Studies Program are required to complete a course totalling 120 credit points made up of compulsory Core Subjects (24 credit points), Elective Subjects (48 credit points) and a Project (48 credit points). The structure of the course allows students to pursue specialised interests through the electives and the project, or to develop new areas of expertise.

Some subjects have prerequisites or assumed knowledge which are determined to be necessary for suitable progress through the subject. Students should seek advice from subject coordinators if they are in doubt as to whether they are qualified to take a subject.

There is a very wide range of subjects offered by Schools across the entire University which are suitable for inclusion in the Master of Environmental Studies program.

Students may choose to take electives that:

- reinforce their own areas of expertise; or
- extend their knowledge and skills into new areas.

By carefully combining the choice of subjects, it is possible to create programs which are tailored to the needs of individual students. The Elective Subjects listed below are not exhaustive, and students may choose elective studies from all graduate programs available in the Faculty of Applied Science, provided that they meet or can satisfy any necessary prerequisites to enrol. These programs include: Earth Sciences, Planning and Assessment, Pollution, Ecology, Remote Sensing, Water Management, Conservation and Land Management, Urban and Social Environments and Safety Science.

Core Subjects		CP
SAFE9271	Environmental Planning and Assessment	8
SAFE9272	Environment and Medicine	8
SAFE9273	Environment and Law	8
SAFE9612	Project (Environmental Studies) *or*	48
SAFE9606	Project (Environmental Studies)	24

Possible Elective Subjects		CP
BIOT7081	Environmental Biotechnology	20
CEIC5630	Industrial Water and Wastewater Engineering	12
CHEM7325	Toxicology, Occupational and Public Health	28
CIVL4306	Engineering and the Environment	10
CIVL9402	Transport, Environment, Community	24
CIVL9403	Theory of Land Use Transportation Interaction	12
CIVL9405	Urban Transport Planning Practice	12
CIVL9408	Transport Systems Design (Urban)	12
CIVL9710	Engineering Risk Management	
CIVL9788	Site Investigations	12
CIVL9790	Slope Instability	12
CIVL9799	Environmental Geomechanics	12
CIVL9851	Unit Operations in Public Health Engineering	12
CIVL9855	Water and Wastewater Analysis and Quality Requirements	12
CIVL9856	Water Treatment	12
CIVL9857	WastewaterTreatment and Disposal	
CIVL9858	Water Quality Management	12
CIVL9859	Environmental Hydrology	12
CIVL9860	Investigation of Groundwater Resources	12
CIVL9861	Environmental and Engineering Geophysics	12
CIVL9862	Fluvial Hydraulics	12
CIVL9872	Solid Waste Management	12
CIVL9875	Hydrological Processes	12
CIVL9876	Water Resource Modelling	12
CIVL9880	Groundwater Modelling	12
CIVL9881	Hazardous Waste Management	12
CIVL9884	Environmental Engineering Science 1	12
CIVL9885	Environmental Engineering Science 2	12
CIVL9888	Environmental Management	12
CIVL9889	Environmental Economics and Law	12
CIVL9891	Groundwater Contamination and Remediation	12
CMED9500	Epidemiology	15
CMED9519	Demography in Community Medicine	10
CMED9612	Environmental Health	10
ECON5116	Environmental Economics	20
FUEL5910	Atmospheric Pollution and Control (Theory)	12
GEOG9130	Soil Studies for Arid Lands Management	12
GEOG9150	Remote Sensing Applications	12
GEOG9160	Directed Problems in Remote Sensing	12
GEOG9210	Computer Mapping and Data Display	12
GEOG9230	Population, Health and the Environment	12
GEOG9240	Principles of Geographical Information Systems	12
GEOG9241	Advanced Geographical Information Systems	12
GEOG9280	Application and Management of Geographical Information Systems	12
GEOG9290	Image Analysis in Remote Sensing	12
GEOG9300	Vegetation Management	12
GEOG9310	River Management	12
GEOG9320	Soil Degradation and Conservation	12
GEOL6231	Coastal Environment Assessment	15
GEOL9010	Groundwater Environments	12
GEOL9011	Hydrogeology	12
GEOL9030	Geological Engineering	12
GEOL9033	Terrain Evaluation	12
GEOL9051	Hydrogeochemistry	12
GEOL9060	Environmental Geology	12
GMAT6532	Spatial Information Systems 1	7.5
GMAT7532	Spatial Information Systems 2	5
GMAT9211	Introduction to Geodesy	12
GMAT9212	GPS Satellite Mapping	12
GMAT9532	Data Acquisitions and Terrain Modelling	12
GMAT9600	Principles of Remote Sensing	12
GMAT9602	Remote Sensing Procedures	12
GMAT9604	Land Information Systems	12
GMAT9606	Microwave Remote Sensing	12
GSBE0503	Postgraduate Design and Methodology	10
HEAL9371	Research and Evaluation Methods	15
HEAL9421	Public Health	15
INDC4120	Chemistry of the Industrial Environment	7.5
INDC4130	Environmental Chemistry of Industrial Processes	5
KCME4301	Environmental Management for the Mining Industry	12
KCME4302	Environmental Assessments in Mining	12
LAND9010	Environmental Heritage Studies	15
LAND9111	Landscape Planning	15
LAND9212	Landscape Planning Methods	15
LAND9213	Land Systems and Management	15
LAND9214	Visual Landscape Assessment	15
LAND9215	GIS in Landscape Architecture	15
LAWS3409	Environmental Law and Policy	30
LAWS3410	Environmental Law	15
MANF9410	Total Quality Management	12
MINE1524	Mining Conservation	12
PROF0003	Qualitative Research Methodology	15
SAFE9211	Introduction to Safety Engineering	12
SAFE9232	Introduction to OHS Law	12
SAFE9242	Effective Behaviour in Organisations	12
SAFE9260	Introduction to Occupational Health	12
SAFE9261	Occupational Hygiene	12
SAFE9262	Occupational Medicine	12
SAFE9263	Chemical Safety and Toxicology	12
SAFE9352	Hazard and Risk Analysis	12
SAFE9531	Industrial and Environmental Noise	12
SAFE9543	Management of Dangerous Materials	12
SAFE9544	Traffic Safety	12
SAFE9553	Radiation Protection	12
SAFE9573	Fire and Explosion	12
SAFE9601	Report (Evironmental Studies)	4
SAFE9602	Report (Evironmental Studies)	8
SAFE9603	Special Project (Evironmental Studies)	12
SCTS3106	Technology, Sustainable Development and the Third World	15
SCTS3116	The Political Economy of Energy and Sustainable Developmen	15
SCTS5303	Knowledge, Power and Public Policy	15
SCTS5309	Analysing Environmental and Technological Controversies	15

Other subjects may be taken on the approval of the Course Coordinator:

All students must undertake an investigative project of 24 or 48 credit points. This project is expected to be complete within one University session (that is, six months). Students will require an academic supervisor for the duration of the project.

Projects normally require the collection and analysis of data, leading to the preparation of a report of about 10,000 words (5,000-6,000 words in the case of a 24 credit point project). The project can be based on studies carried out at the student's place of work, or at some other suitable location.

The objective of the Project is for the student to demonstrate skills in research design, data acquisition and analysis, critical synthesis, and presentation of findings.

8075
Master of Applied Science (Ergonomics)

MAppSc

The Master of Applied Science degree in Ergonomics is multi-disciplinary and is designed to accept students from a range of backgrounds. To provide for a common base of knowledge some students are required to study some preliminary subjects which depend on their background.

Candidates are required to complete a total of 134 credit points, made up of 60 credit points of compulsory core subjects, 36 credit points of elective subjects and a 48 credit point Project. For candidates with previous ergonomics qualifications a 72 credit point Project may be undertaken in place of 24 credit points of subjects.

Preliminary Subjects
Students are required to demonstrate either a satisfactory standard of understanding of all these preliminary subjects, or to pass all of them in addition to the 36 credit points required to fulfil the requirements of the Course.

		CP
ANAT6151	Introductory Functional Anatomy	7.5
SAFE9011	Principles of Engineering Mechanic	12
SAFE9012	Statistics for Health and Safety Scientists	12

Core Subjects (12 credit points)

SAFE9224	Principles of Ergonomics
SAFE9242	Effective Behaviour in Organisations
SAFE9424	Applied Ergonomics
SAFE9425	Physical Ergonomics
SAFE9426	Ergonomics and New Technology

Elective Subjects (12 credit points)

BIOM9541	Mechanics of the Human Body
SAFE9211	Introduction to Safety Engineering
SAFE9232	Introduction to Occupational Health and Safety Law
SAFE9260	Introduction to Occupational Health
SAFE9264	Assessment of the Workplace Environment
SAFE9342	Management for Safety
SAFE9343	Innovation, Productivity and Safety
SAFE9352	Hazard and Risk Analysis
SAFE9523	Plant and Construction Safety
SAFE9544	Traffic Safety
SAFE9551	Experimental Biomechanics

Note: Other graduate subjects offered by other Schools may be taken subject to the approval of both the School concerned and the Ergonomics Course Coordinator. Not all elective subjects are offered every year.

Project
Students are required to undertake an investigative project and to present a written report according to guidelines established by the Department. The project will normally be of 48 credit points value (SAFE9612) although in special cases, for example when a student enters the course with substantial background in the core material, a superior Project of 72 credit points value (SAFE9618) may be taken.

Projects may be based on studies carried out at the student's workplace, in the Department's laboratories or at any other appropriate place with the agreement of the Ergonomics Course Coordinator.

Each student is required to present progress reports at regular seminars which all Project students are expected to attend. Generally there are at least three seminars in each Session.

8545
Master of Engineering Science (Industrial Safety)

MEngSc

The Master of Engineering Science degree is obtained by satisfactory completion of 120 credits points of study, 48 of which represent a project. The degree is normally completed by one year of full-time study or two years of part-time study. Part time students may undertake the project at their place of work. 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.

Entry to the Master of Engineering Science course requires a degree at Honours level, or at Pass level to a superior standard in a four-year course in Engineering or other approved discipline. This 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.

Students undertake 36 credits points of compulsory subjects, and 36 credit points of electives. The electives may be taken from any School in the Faculties of Applied Science or Engineering, subject to the agreement of the Head of School concerned and the Head of the Department of Safety Science. This enables students to extend their specialist knowledge in their own discipline, to undertake additional general management subjects or to extend their studies into the broader area of occupational health, safety and management.

Core Subjects (12 credit points)

SAFE9213	Introduction to Safety Engineering (M)	
SAFE9242	Effective Behaviour in Organisations	
SAFE9352	Hazard and Risk Analysis	

Project

Students must undertake an investigative project of 48 credit points value. Projects may be based on studies carried out at a student's place of work, or in the laboratories of the Department, or at any other place by arrangement with the Head of the Department. A range of instrumentation is available in the Department, and liaison can be arranged with industry if students do not have a suitable project at their place of work. Each student is required to present a progress report at regular seminars which all project students are expected to attend. Generally there are at least two such seminars in each Session.

Electives

Students may choose postgraduate electives either from the Master of Safety Science course or from other schools in the University. A full list of subjects can be obtained from the various faculty handbooks. The subjects listed below are a selection of subjects related to safety from other schools.

Elective Subjects from other Schools:		**CP**
MECH9325	Fundamentals of Noise	12
MECH9326	Advanced Noise	12
MNGT0373	Organisational Design	10
CIVL9726	Construction Law and Professional Practice	12
ELEC9410	Robotics Automation and Productivity Technology	12
IROB5701	Australian Industrial Relations	20
MANF9400	Industrial Management	12
MANF9410	Inspection and Quality Control	12
MECH9400	Mechanics of Fracture and Fatigue	12
MINE1224	Mining Engineering Technology	24
MINE1534	Environmental Conditions in Mines	12
MINE9164	Atmospheric Pollution Control	7.5

Other Subjects from AGSM by arrangement

8671
Master of Safety Science

MSafetySc

Candidates are required to complete a program totalling 180 credit points made up of 72 credit points of compulsory subjects, 60 credit points of electives and a 48 credit point project. Students are also required to demonstrate either a satisfactory standard of understanding of all the preliminary subjects listed below, or to pass those subjects in addition to the 180 credit point program. This enables students from a wide range of disciplines (such as engineering, science, medicine, physiotherapy and education) to reach an adequate standard of comprehension for studying the compulsory subjects.

Preliminary Subjects		**CP**
ANAT6151	Introductory Functional Anatomy	7.5
SAFE9011	Physical Principles of Safety	12
SAFE9012	Statistics for Health and Safety Scientists	12

Core Subjects

Core subjects, totalling 72 credits, represent the central theme of Safety Science and are compulsory.

SAFE9260	Introduction to Occupational Health	12
SAFE9211	Introduction to Safety Engineering	12
SAFE9224	Principles of Ergonomics	12
SAFE9232	Introduction to Occupational Health and Safety Law	12
SAFE9242	Effective Behaviour in Organisations	12
SAFE9352	Hazard and Risk Analysis	12

Electives

Students are required to take at least 60 credit points from the list of electives for the Master of Applied Science (OHS) 8044.

Students may select as electives up to two graduate subjects offered by other Schools in the University, subject to the approval of the School concerned and the Head of the Department. A selection of approved subjects is shown in the list of electives for the Master of Applied Science (OHS) 8044.

Project

Project Students are required to undertake an investigative project and to present a satisfactory report. The project will normally be of 48 credit points value (SAFE9612). In special circumstances, for example when a student enters the course with substantial prior knowledge in the coursework, a superior Project Report of 72 credit points value (SAFE9618) may be permitted. Projects may be based on studies carried out at a student's place of work, or in the laboratories of the Department, or at any other place by arrangement with the Head of the Department. A range of instrumentation is available in the Department and liaison can be arranged with industry if students do not have a suitable project at their place of work. Each student is required to present a progress report at regular seminars which all project students are expected to attend. Generally there are at least three such seminars in each Session.

5480
Graduate Diploma in Safety Science

GradDip

The Graduate Diploma in Safety Science Course consists of 96 credits points made up from 72 credit points of core subjects and 24 credit points of electives. Furthermore, students are required to demonstrate a satisfactory understanding of the preliminary subjects or pass these in addition to the 96 credit point program.

Preliminary Subjects

To broaden the base of their previous tertiary studies, students take up to three preliminary subjects from the list below. The selection of these subjects is determined according to previous qualifications and experience. Thus

engineers are usually required to include Introductory Functional Anatomy, and students from a health sciences background include Physical Principles of Safety. Students are expected to enter the course with a basic understanding of mathematics, physics and Chemistry. Where this is lacking students must undertake a bridging course.

		CP
ANAT6151	Introductory Functional Anatomy	7.5
SAFE9011	Physical Principles of Safety	12
SAFE9012	Statistics for Health and Safety Scientists	12

Core Subjects
Core subjects, totalling 72 credit points, represent the central theme of safety science and are compulsory.

SAFE9211	Introduction to Safety Engineering	12
SAFE9224	Principles of Ergonomics	12
SAFE9232	Introduction to Occupational Health and Safety Law	12
SAFE9242	Effective Behaviour in Organisations	12
SAFE9260	Introduction to Occupational Health	12
SAFE9352	Hazard and Risk Analysis	12

Elective Subjects
To complete the requisite total of 30 credit points, students are required to select one or more subjects from the list of Electives or Core Subjects presented for the MSafetySc progam. In special cases a 12 credit point Report in Safety Science SAFE9603 may be taken.

5485
Graduate Diploma in Ergonomics

GradDip

The Graduate Diploma in Ergonomics is multidisciplinary and is designed to accept students from a range of backgrounds. To provide for a common base of knowledge some students are required to study some preliminary subjects which depend on their background.

Candidates are required to complete a total of 96 credit points, made up of 60 credit points of compulsory core subjects, and 36 credit points of elective subjects.

Preliminary Subjects
Students are required to demonstrate either a satisfactory standard of understanding of all these preliminary subjects, or to pass all of them in addition to the 36 credit points required to fulfil the requirements of the Course.

ANAT6151	Introductory Functional Anatomy	7.5
SAFE9011	Physical Principles of Safety	12
SAFE9012	Statistics for Health and Safety Scientists	12

Core Subjects

SAFE9224	Principles of Ergonomics	12
SAFE9242	Effective Behaviour in Organisations	12
SAFE9424	Applied Ergonomics	12
SAFE9425	Physical Ergonomics	12
SAFE9426	Ergonomics and New Technology	12

Elective Subjects
To complete the requisite total of 96 credit points, students are required to select one or more subjects from the list of Electives presented for the MAppSc (Ergonomics). In special cases a 3 credit point Report in Safety Science SAFE9603 may be taken which must involve the solution of a practical ergonomics problem.

5488
Graduate Diploma in Environmental Studies

GradDip

The Graduate Diploma in Environmental Studies is similar to the Masters Program in Environmental Studies **8045**, in that it is a faculty-wide, interdisciplinary course, administered by the Department of Safety Science. The course draws from schools, departments, and centres throughout the University.

The overall objective of the Graduate Diploma in Environmental Studies course is to provide students and graduates with:

- A conceptual framework for the study of environmental issues and problems, including:
- an understanding of natural systems and processes;
- an appreciation of how human activities impact on the environment;
- the ways in which these areas interact, including understanding of scientific, social, philosophical, economic, ethical, legislative and political concepts.
- knowledge and skills in a range of environmental subject areas, including environmental assessment, environmental planning, environmentally oriented decision-making and the ways in which various disciplines may be integrated together.

The course is designed to study the nature of environmental problems and the methodology of evaluation. Emphasis is placed on the development of relevant skills in environmental analysis and planning.

One further objective of the course is to provide opportunities for students to increase their skills in environmental management by extending their knowledge of environmental systems and processes. The course is one that has practical value which will help the careers of graduates.

Entry qualifications
A three year honours degree or equivalent, in a field relevant to environmental studies, or a four year degree in another field. Under exceptional circumstances, and at the discretion of the head of school, applicants with extensive experience in the environmental field, or with other professional or academic attainments, may also enrol in the Graduate Diploma program.

Course Requirements
Students enrolled on the Graduate Diploma in Environmental Studies are required to complete a course totalling 96 credit points made up of compulsory Core Subjects (24 credit points) and Elective Subjects (72 credit

points). The structure of the course allows students to pursue specialised interests through the electives, or to develop new areas of expertise. Students may upgrade to the Masters in Environmental Studies upon completion of satisfactory progress. In such cases, students will be required to complete 144 credits.

Core (minus the research project) and elective subjects are the same as those listed under the entry for the Master of Environmental Studies (8045).

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 person for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

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.

SAFE9142
Organisational Communication for Safety
Staff Contact: Dr Ronald Rosen
CP12

Overview of development of communication skills. Principles and processes of effective communication. Communication exercises. Designing information forms. Review of currently available computer based occupational health and safety data systems. Locating sources of occupational health and safety information. Design and conduct of personnel training and development progams. Organisational communication diagnosis and change.

SAFE9211
Introduction to Safety Engineering
Staff Contact: Dr Ronald Rosen
CP12
Assumed knowledge: SAFE9011 or PHYS1022
Note/s: Students with an engineering or physics background may take SAFE9213 which covers similar material.

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 Ronald Rosen
CP12
Assumed knowledge: SAFE9011 or PHYS1022

Note/s: This a modified version of SAFE9211 which is designed principally for engineers.

The following workplace topics are considered; safety management, ergonomics, equipment design and task consideration, machine guarding, electrical safety, fire and explosion, management of dangerous materials, ventilation, radiation protection, noise and vibration control, environmental safety, transport safety, safety issues in different industries.

SAFE9224
Principles of Ergonomics
Staff Contact: Mr Roger Hall
CP12
Assumed knowledge: Basic statistics and mechanics

The subject will give an introduction to ergonomics, emphasizing the principles of designing user-centred, human-machine-environment systems. Topics include:definition of and justification for ergonomics, design and human error, human capabilities and limitations, controls and displays, design of human-machine-environment systems, job design and work organisation, introduction to anthropometry, design of workplaces, introduction to manual handling and the physical environment, and, introduction to product design and human-computer interaction.

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.

SAFE9264
Assessment of the Workplace Environment
Staff Contact: Dr Kamal Kothiyal
CP12
Assumed knowledge: SAFE9261

An experimental and workplace assessment based subject, where students will be required to assess physical and chemical hazards encountered in the occupational environment.

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.

SAFE9267
Research Methods in Laboratory Science
Staff Contact: Dr Boban Markovic
CP12
Assumed knowledge: SAFE9263

A laboratory based subject which will provide the basic requirements of laboratory based research, especially in chemical safety and applied toxicology. The subject covers literature review, methodology, experimental design, data collection and analysis, discussion and presentation skills. Assessment will be made through preparation of a major project report.

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.

SAFE9342
Management for Safety
Staff Contact: Ms Dianne Gardner
CP12
Assumed knowledge: SAFE9242

Management models and structure The structure and responsibilities of a safety manager. Integrating safety into the organisation and management systems; cost effectiveness of safety programs. Selection and training of personnel. Comparison and evaluation of occupational health and safety 'off the shelf' data management systems. The safety practitioner as change agent.

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.

SAFE9352
Hazard and Risk Analysis
Staff Contact: Prof Jean Cross
CP12
Assumed knowledge: SAFE9012 (Introductory Statistics)

Causes of accidents and defensive strategies; energy storage and transfer; epidemiology of accidents; reduction of loss from accidental injury; human factors; the environment and accidents. Introduction to risk management; quantification of risk: risk benefit concepts. System reliability and fault tree analysis in the study and control of accidents; Hazan, Hazop and Mort. Study of some major accidents; accident investigation and analysis; case studies in transport, industry, recreation and the home.

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.

SAFE9425
Physical Ergonomics
Staff Contact: Dr Kamal Kothiyal
CP12
Assumed knowledge: SAFE9224 or equivalent

The focus of this subject is on the physical capabilities of humans at work and the effect of the physical environment on human performance. Measurement of relevant physical parameters and design and evaluation by computer. Topics include; applied anthropometry, workspace and workstation design, biomechanical models, emg measurement, manual materials handling, work physiology, fatigue, the visual, auditory and thermal environments, and the effect of vibration.

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, usability and its assessment, user interface design, evaluation techniques, guidelines and standards, and the introduction of new systems into organisations.

SAFE9523
Plant and Construction Safety
Staff Contact: Dr Kamal Kothiyal
CP12
Assumed knowledge: SAFE9011 or PHYS1022

Strength of materials, materials failure. Machinery contact dangers; machine guarding; safety during maintenance. Materials handling safety; cranes, slings, forklift trucks, conveyors. Construction safety; ladders, scaffolds, formwork, excavations. Structural failures, fracture, pressure vessels, non-destructive testing.

SAFE9531
Industrial and Environmental Noise
Staff Contact: Head of School
CP12

The course covers the physical, perceptual and legislative aspects of noise in an industrial and environmental context. Descriptive properties, propagation, loudness and frequency: Measurement, decibels, Hertz, octaves, time and frequency weighting, spectral analysis; Perception, loudness, annoyance, phones dB(A) Leq Lbgt: Anatomy and function of the ear: Industrial deafness, Audiometry exercise in measuring hearing levels. Instrumentation, meters, filters, analysers and sound sources; Propagation in different environments, reverberent, free field, behaviour in different medium. reflection, absorption, transmission, barriers and enclosures; Industrial Noise NSW Hearing Conservation regulations, measurement and assessment of risk and control of industrial noise. Environmental Noise, NSW Noise Control Act. Exercise in the measurement and control of environmental noise. Effects of aircraft and traffic noise and policy directions. Components of an environmental impact statement.

SAFE9533
Electrical Safety
Staff Contact: Prof Jean Cross
CP12

Effects of current flow and electric and magnetic fields; elementary circuit representation, typical supply situations; likely dangerous conditions; static electricity; hazardous locations; standards and codes of practice; treatment of electric shock. Electrical causes of fire and explosion; prevention of electrical accidents.

SAFE9543
Management of Dangerous Materials
Staff Contact: 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.

SAFE9553
Radiation Protection
Staff Contact: Dr Ronald Rosen
CP12
Assumed knowledge: SAFE9211 or SAFE9213

Principles and practices of radiation protection for both ionising and non ionising radiation. Radiation physics, detection and measurement; background radiation; biological effects of radiation; dose limits; technical controls for radioactive sources and irradiating apparatus. Codes of safe practice; radiological monitoring and personal dosimetry; storage, transport and disposal of sources; environmental impact; administrative controls; emergency procedures; control of nonionising radiation. Practical work and site visit.

SAFE9573
Fire and Explosion
Staff Contact: Head of School
CP12
Assumed knowledge: SAFE9211 or SAFE9213

Properties of explosive and flammable materials; chemistry and physics of combustion reactions; explosion, detonation and blast waves; fire and smoke behaviour.

SAFE9601
Report in Safety Science
Staff Contact: Course Coordinator
CP4

A four credit report on a topic in safety science.

SAFE9602
Report in Safety Science
Staff Contact: Course Coordinator
CP8

A eight credit report on a topic in safety science.

SAFE9603
Special Report in Safety Science
Staff Contact: Course Coordinator
CP12

Only for students enrolled in the Graduate Diploma courses.

SAFE9606
Special Report in Safety Science or Environmental Studies
Staff Contact: Course Coordinator
CP24

SAFE9609
Project
Staff Contact: Dr Ronald Rosen
CP36

SAFE9612
Project in Safety Science or Environmental Studies
Staff Contact: Dr Ronald Rosen (Safety Science)
Staff Contact: A/Prof Chris Winder (Environmental Studies)
Staff Contact: Mr Roger Hall (Ergonomics)
CP48

SAFE9618
Project Report
Staff Contact: Professor Jean Gross
CP72

Centres in the Faculty of Applied Science

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

The Faculty of Applied Science has ten Centres either located within relevant Schools or in association with other Faculties.

Bioengineering Centre
Centre for Applied Polymer Science
UNESCO Centre for Membrane and Séparation Technology
Centre for Minerals Engineering
Centre for Particle and Catalyst Technologies
Centre for Remote Sensing and Geographic Information Systems
Energy Research, Development and Information Centre (ERDIC)
Food Industry Development Centre
Key Centre for Mines
UNSW Groundwater Centre

Three Centres offer programs which have their own subject identifier. They are the Centre for Minerals Engineering (MINP), the Centre for Petroleum Engineering Studies (PRTL), and the Key Centre for Mines (KCME). The subjects for the Centre for Minerals Engineering are located with the subjects for the School of Chemical Engineering and Industrial Chemistry, those for the Key Centre for Mines are located with the School of Mines.

In addition the Faculty of Applied Science is actively involved with eight Co-operative Research Centres (CRCs) established under the Commonwealth Government's program of CRCs announced in 1991. These are:

- Australian Maritime Engineering CRC
- Australian Petroleum CRC
- CRC for Aerospace Structures
- CRC for Biopharmaceutical Research
- CRC for Black Coal Utilisation
- CRC for Waste Management and Pollution Control
- CRC for Food Industry Innovation
- CRC for Premium Quality Wool

Bioengineering Centre

Director:
Professor P Gray

The Bioengineering Centre, within the Department of Biotechnology, aims to develop and coordinate research and continuing education activities in the multidisciplinary areas of bioengineering and recombinant-DNA technology.

Recent scientific advances and the ability to manipulate DNA in animal, plant and microbial cells are having far-reaching implications. The commercial applications of these scientific advances involve research and development work in a number of multidiscinplinary fields. The Bioengineering Centre provides the mechanism to facilitate this multidisciplinary research.

The Centre assists in technology transfer to Australian industry and contributes to the education program of the University by providing short courses and symposia both in Australia and overseas.

Research programs range from microbial genetics to microbial mineral processing. Extensive facilities for animal and plant cell culture and for the production of recombinant-DNA derived products are utilised. Many of the Centre's research programs are collaborative, involving researchers from other areas of the University, industry and other organisations.

Centre for Applied Polymer Science

Director:
Associate 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 are drawn from ten Departments and Centres at UNSW with 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.

An example of interdisciplinary collaboration relates to recycling and waste minimisation. A program entailing aspects of design, polymer durability and selection is being mounted. New developments in polymeric packaging are also being investigated by the interaction of Food Technologists, Polymer Chemists and Engineers.

UNESCO Centre for Membrane Science and Technology

Directors:
Professor HGL Coster (Biophysics Group)
Professor AGFane (Chemical Engineering Group)

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 the Faculty of Science). 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, Japan, Korea, Thailand, 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.

Centre for Minerals Engineering

Director:
Dr T Tran

The Centre for Minerals Engineering (CME) coordinates and conducts teaching and research activities of relevance and concern to the mineral industry. Acting as a focal point to coordinate activities in supporting the mineral 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 sytems, distributors, and spiral concentrators.

Staff associated with the Centre participate in various training programs overseas. In collaboration with the Key Centre for Mines, workshops on 'gold exploration, mining and processing' and 'mineral engineering and environmental management' were conducted in Indonesia and Vietnam in 1991 and 1993.

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:
Associate Professor J Raper

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. Some 120 companies have sent samples for particle characterisation over the last two years. This has been achieved in conjunction with Unisearch (UNSW's 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.

Centre for Remote Sensing and Geographic Information Systems

Director:
Professor BC Forster

The Centre is a joint multidisciplinary enterprise of the Faculty of Applied Science and the Faculty of Engineering aimed at facilitating research in the broad area of spatial information systems, which include remote sensing, geographical information systems and land information systems. It maintains a remotely sensed and geographical information system data repository.

Research interests include applications of artificial intelligence in remote sensing, neural networks in remote sensing, satellite mapping of bushfires, and vegetation mapping from remote sensing images. Other interests include monitoring urban areas using high resolution satellite remotely sensed data and spatial information systems for road based transport planning, evaluation and design. Applications using radar form a core interest of the Centre.

There are more than 30 academic staff associated with the Centre. Active links are maintained with researchers in Asia, North America, China and Europe.

The Centre offers undergraduate and postgraduate teaching and research in remote sensing and geographical information systems. The Centre also offers short courses on remote sensing and geographical information systems to the wider community.

Graduate Programs in Geographic Information Systems

Master of Applied Science in Geographic Information Systems Course **8027.1000**

The Masters degree program in Geographic Information Systems is offered in both Geography and Geology within the Faculty of Applied Science. Entry into either discipline depends on the background of the applicant and the orientation of the proposed program. Detailed information on this course is listed under the School of Geography section in this handbook.

The Masters degree program is also offered in the Faculty of Engineering as a Master of Engineering Science Course **8652**. This course has a stronger engineering bias.

Graduate Programs in Remote Sensing

The graduate programs in Remote Sensing are offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either Faculty depends on the background of the applicant and the orientation of the proposed program.

Programs are available leading to the award of:

Master of Applied Science in Remote Sensing Course **8047.2000**

Graduate Diploma in Remote Sensing Course **5047.2000**

Detailed information on these courses is listed under the School of Geography and the School of Geology Sections in this handbook.

Energy Research, Development and Information Centre (ERDIC)

Director:
Associate Professor GD Sergeant

UNSW is a major centre for energy research and development in Australia across the full spectrum of energy technologies and issues. The Univerisy 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 enquiry 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.

Food Industry Development Centre

Acting Director:
Professor KA Buckle

This is a Commonwealth Key Centre for teaching and research located in the Department of Food Science and Technology within the School of Applied Bioscience.

The Food Industry Development Centre (FIDC) was set up to develop research in the rapidly changing field of food products. The Centre maintains close links with industrial partners who have adopted some of the research results for further study.

One of the major interests of research in the Centre has been food microbiology. Two successful research projects involved fermentation technology. The studies were 'The development of food colours using fermentation technology' and 'Study of fermentation procedures for the development of soy and other non-milk protein cheese analogues'. Other research programs based on the effect of ozone on the microbial ecology of foods and food processes have resulted in the initiation of three major research investigations.

The Centre is currently involved in research into lipid chemistry. The Centre's facilities are being upgraded with the acquisition of lipid/flavour analysis equipment.

The FIDC also managed projects for a variety of research and development programs for industry clients, with the Centre serving as a bridge between the food industry's research and development requirements and the strong technology base at UNSW.

Key Centre for Mines

Director:
Dr MB Katz

It has the prime objective of providing appropriate postgraduate training for professionals within the mining industry who work in remote locations. It also aims to promote new collaborative research within the two universities for the mining industry.

The Key Centre currently delivers a postgraduate program leading to either a Graduate Diploma or a Masters in Mining Management. The program is delivered by residential short courses and assignments and makes significant use of industry based presenters. The Key Centre also manages the presentation of a similar program in Geological Data Processing. In addition to the postgraduate programs, the Key Centre runs individual short courses on a commercial basis. It also offers customised short courses for companies and special purpose training programs, mostly for overseas professionals.

The Key Centre's main research role is to promote technology transfer through its short course program. To achieve this, it presents between 20 and 25 short courses each year and five special purpose seminars. Other research initiatives include the award of five PhD scholarships, and the award of three research support grants to collaborative teams drawn from both universities.

Information on the Centre's courses is detailed under the School of Mines section in this handbook.

UNSW Groundwater Centre

Director:
Dr JA Jankowski

The UNSW Groundwater Centre was created in 1987 and is a joint enterprise of the Faculties of Engineering and Applied Science. The Centre's facilities are based at the Water Research Laboratory in Manly Vale and in the Department of Applied Geology.

The Centre organises a Masters course in Groundwater Studies, as well as undergraduate and PhD training. The Masters course is completed full-time over a period of twelve months and offers specialisations in contaminant

hydrogeology and groundwater resource development. Students from Iran, Canada, UK, Zambia, Malaysia, Thailand, Indonesia, and Botswana have studied at the Centre in recent years, as well as many Australian students.

The staff at the Centre work closely with the Cooperative Research Centre for Waste Management and Pollution Control to develop geophysical techniques for mapping dense non-aqueous phase liquid contamination of unconsolidated aquifer formations. This work has involved the development of new sample acquisition and recovery techniques and the development of integrated hydrogeochemical and geophysical laboratories at the Water Research Laboratory.

Major research interests include the development of hydrogeochemical and biogeochemical models for the occurrence of dry land salinity; the characterisation of flow in fractured aquifers using a combination of isotope techniques; and the assessment of airborne multispectral scanner and airborne radar for the mapping of aquifer recharge and discharge areas.

Several recent research projects have been targeted at understanding the movement of contaminants in the Botany Sands aquifer in Sydney. A number of deep multilevel piezometers have been installed in the Botany Basin in conjunction with a comprehensive test facility at East Lakes where 815 mini-piezometers allow the accurate tracking of contaminant plumes.

The Centre offers specialised graduate courses in Groundwater Studies and carries out general teaching in Hydrogeology to Applied Science and Engineering postgraduate students.

Information on the Centre's courses is detailed under the Department of Applied Geology, School of Mines, section in this handbook.

The Australian Petroleum Cooperative Research Centre

Director
Professor WV Pinczewski

The Australian Petroleum Cooperative Research Centre (APCRC) was established in 1991 to bring together Australia's four main oil and gas research groups. These groups are the CSIRO Divisions of Exploration Geoscience and Geomechanics (now amalgamated into a new Division of Petroleum Resources), the Centre for Petroleum Engineering at UNSW, and the National Centre for Petroleum Geology and Geophysics at the University of Adelaide. Subsequently the Departments of Geophysics and Geochemistry at Curtin University have also joined. The Centre provides industry with a wide range of research, research and development, consulting and specialised laboratory services.

The focus of the APCRC's research and training scheme has been on upstream activities - exploration and production to the well-head, with an emphasis on problems unique to the Australian environment. The Centre is currently running eight research programs. The Improved Oil and Gas Recovery Research Program aims to increase Australia's output of oil and gas by recovering oil from existing fields more efficiently, and by developing new technologies such as injecting carbon dioxide and methane into oil reservoirs which will no longer produce through more conventional methods. A more recent focus has been on the recovery of gas from low permeability reservoirs.

In addition the Centre for Petroleum Engineering provides major scientific input for the development of improved technology in the following programs:

For students, the APCRC offers the opportunity of entering the field with marketable skills. By working side-by-side with researchers from the CSIRO, UNSW, the Adelaide and Curtin University Centres and experts from the petroleum industry, students gain practical experience and expertise.

CRC for Biopharmaceuticals

University Contact:
Professor PP Gray

The Cooperative Research Centre for Biopharmaceutical Research was incorporated in 1992. The partners in the Centre include UNSW's Department of Biotechnology, School of Physiology and Pharmacology, and Biomedical Mass Spectrophotometry Unit; the Garvan Institute of Medical Research, St Vincent's Hospital, Sydney; the Biomolecular Research Institute, Peptide Technology Ltd; CSL Ltd; and Johnson and Johnson Research Pty Ltd.

The primary aim of the Biopharmaceutical Research CRC is to provide a coordinated research base to aid the development of the Australian biopharmaceutical industry. To achieve this goal, the Centre functions as a national centre for both the development of new internationally competitive biopharmaceutical products, and the education of researchers in the combination of biopharmaceutical research techniques and their integration with the industrial goals necessary to develop products for the world market. The partners of the Cooperative Research Centre have all the necessary expertise for the discovery, design and development of novel biopharmaceutical products resulting from the recent rapid advances in the fields of genetic engineering and biotechnology.

The CRC provides a fertile environment for postgraduate study, as students can see the results of their research being developed into useful products.

CRC for Black Coal Utilisation

University Contact
Dr V Sahajwalla

The Centre was established in 1994. Research participants involved are the School of Materials Science and Engineering, CSIRO Division of Coal and Energy Technology, the University of Newcastle, the University of Queensland and the Australian Coal Industry Research Laboratories. Industry participants involved are ARCO Coal Australia, BHP Australia Coal, CRA Group, Oakbridge, Pacific Power Group and Peabody Resources.

The Centre's research objectives are to maximise the value and environmental performance of Australian coals -

- Generate new knowledge to improve the competitiveness of Australian coals; and
- Understand the performance of Australian coals in new technologies.

Research to be undertaken at UNSW includes:

- Development of XRD technique to evaluate coal/gas reaction performance.
- Coal structure and its influence on coal/gas high temperature reactions.
- Slag surface tension determination and its modification to control slag/char interfacial phenomena.
- Influence of slag/char/gas interactions on high temperature reaction kinetics.

CRC for Food Industry Innovation

Director:
Professor NW Dunn

The Centre was established in 1993 with the School of Applied Bioscience, the Schools of Biochemistry and Molecular Genetics and Immunology (Faculty of Biological and Behavioural Sciences), CSIRO, and three industry partners to provide a coordinated research and educational base to generate development of improved and novel natural food ingredients, principally through the use of microorganisms.

The five partners in the CRC have the combined expertise in research and commercialisation to market the first ingredients within four years. The ingredients that the Centre aims to develop include starter cultures, anti-microbial agents, antioxidants, fat substitutes, texture modifiers, colours, flavours, probiotics and biocontrol agents.

Currently there are eight research programs which focus on different areas which may generate commercial products. Research areas include molecular genetics, cellular physiology, bio-chemistry and kinetics of food approved and other potentially useful microorganisms. Microbial processes will be developed and optimised through to 100 litre pilot-scale capacity and these studies will include ingredient recovery and formulation. Expertise exists for evaluation of ingredients in food formulation and nutritional evaluation.

Undergraduate and postgraduate (formal MAppSci and PhD) programs provide training relevant to the total area. Research programs contribute to the generic resource of the CRC and provide students with a direct opportunity to interact with national and international food / biotechnology companies.

CRC for Premium Quality Wool

University Contact
Professor R Griffiths

The Cooperative Research Centre for Premium Quality Wool was established in 1993 in the School of Fibre Science and Technology. The other participants are the Universities of New England and Western Australia, CSIRO, and the Wool Research and Development Corporation.

The Centre addresses the major issues involved in wool demand such as lightweight construction, softness and ease of care. The research is directed at the performance of the fibre and how this may be improved either by genetic, nutritional and physiological manipulation or through direct chemical and physical intervention.

The research program has a balance of long-term strategic elements including biomolecular and ultrastructural components as well as shorter-term tactical projects. It is designed to focus on improving product quality at all stages of the production process from wool follicle to finished fabric.

Servicing Subject Descriptions

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

The following subjects are offered by other Faculties at UNSW, and contribute as either part of courses contained in this handbook, or as electives.

ACCT9001
Introduction to Accounting A
Staff Contact: School of Accounting Office
CP7.5 S1 L1.5
Note/s: Architecture - 2 credit points compulsory for BBuild degree course students.

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 of Accounting Office
CP7.5 S2 L1.5
Prerequisite: ACCT9001
Note/s: Architecture - 2 credit points; compulsory for BBuild degree course students.

This subject introduces non-commerce students to managerial accounting: long-range planning, budgeting and responsibility accounting; cost determination, cost control and relevant cost analyses.

ANAT6151
Introductory Functional Anatomy
Staff Contact: Dr E Tancred

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.

BIOC2101
Principles of Biochemistry
Staff Contact: Dr K Moon, Dr G King
CP15 S1 HPW6
Prerequisites: BIOS1101 and BIOS1201, CHEM1101 and CHEM1201 or CHEM1002
Note/s: Excluded BIOC2312, BIOC2372, CHEM2929. Enrolment in this subject may be subject to quota restrictions. Such restrictions will only apply to students taking this subject as an elective part of their program.

An introduction to modern biochemistry covering fundamental aspects of the structure-function relationships of proteins and an overall coverage of intermediary metabolism. Major topics to be covered will include: the nature and function of enzymes; the metabolic working of cells, tissues and organs; the interrelationships between the pathways of carbohydrate, lipid and amino acid metabolism; the vital role of enzymes and hormones in catalysis and metabolic regulation; the energy-trapping mechanisms of animals and plants; interesting variations on the central metabolic pathways in various life forms. Practical work to complement the lectures and to introduce the principles of biochemical analysis.

BIOC2201
Principles of Molecular Biology
Staff contact: Dr T Stewart, Mr H Shoory
CP15 S2 HPW6
Prerequisite: BIOC2101
Note/s: Excluded BIOC2312, BIOC2372

Enrolment in this unit may be subject to quota restrictions. Such restrictions will only apply to students taking this unit as an elective part of their program.

This unit provides an introduction to modern molecular Evolutionary and Functional Biologynd covers the molecular mechanisms of gene expression and the fundamental aspects of recombinant DNA technology. The major topics to be covered include: The structure and function of DNA and RNA The replication and transcription of DNA Translation of the genetic code into an amino acid sequence during protein synthesis. Regulation of gene expression. Manipulation of DNA including fragmentation by restriction enzymes, cloning of DNA fragments into vectors, hybridization analysis and principles of DNA sequencing. Protein structure and function, protein engineering and site-directed mutagenesis. Amplification of DNA by the polymerase chain reaction (PCR). Practical work to complement the lectures.

BIOC3111
Molecular Biology of Proteins
Staff Contact: Dr G King
CP15 S1 HPW6
Prerequisites: BIOC2312 or BIOC2372 or BIOC2101 and BIOC2201, CHEM2021 or CHEM2041
Note/s: Excluded 41.102, 41.102A

Modern aspects of the structure function relationships of proteins including discussion of the latest techniques of protein characterisation. Topics include: separation and analytical procedures; determination of amino acid sequence data; the nature of protein and protein ligand interactions including aspects of substrate binding, enzyme kinetics and enzyme mechanisms; the molecular architecture of proteins from the standpoint of the relationships among primary, secondary, tertiary and quaternary structures; aspects of protein engineering. Practical work illustrates and complements the lectures and provides experience with modern techniques of protein molecular biology.

BIOC3121
Molecular Biology of Nucleic Acids
Staff Contact: A/Prof A Mackinlay
CP15 S1 HPW6
Prerequisites: BIOC2312 or BIOC2372 or BIOC2101 and BIOC2201, CHEM2021 or CHEM2041
Note/s: Excluded 41.102, 41.102A

Detailed analysis of gene structure and function including: structure and properties of polynucleotides such as DNA and RNA; structure of chromatin; mechanisms and regulation of gene replication, transcription and translation; recombinant DNA technology, nucleic acid sequencing, DNA-DNA and DNA-RNA hybridisation as important tools of modern molecular biology; protein production using recombinant DNA systems. Practical work illustrates and complements the lectures and provides experience with contemporary biochemical techniques.

BIOC3281
Recombinant DNA Techniques and Eukaryotic Molecular Biology
Staff Contact: A/Prof A Mackinlay
CP15 S2 HPW6
Prerequisite: BIOCP12121
Note/s: Excluded 41.132, 41.102E.

The organisation of the genomes of higher organisms derived mainly from the application of recombinant DNA technology and related techniques. Methods used for the isolation, identification and characterisation of eukaryotic genomes in terms of the organisation of single copy and repeated sequences and of coding and non-coding sequences and of several gene clusters, eg the alpha and beta globin gene cluster. Mechanisms known to operate in the control of eukaryotic gene expression, both at the DNA level and at the level of RNA processing. Review of several specialised genetic systems in plants and animals such as mitochondria, chloroplasts and RNA and DNA tumour viruses. Practical work provides training in the use of sterile techniques and in working with polynucleotides under nuclease-free conditions, using basic techniques such as hybridisation and DNA sequencing.

BIOC3271
Cellular Biochemistry and Control
Staff Contact: A/Prof M Edwards
CP15 S2 HPW6
Prerequisite: BIOC2312 or BIOC2372 or BIOC2101 and BIOC2201

Cell biology from a molecular viewpoint. Biochemical aspects of cellular organisation and how they are integrated and controlled. The arrangement of the component molecules of organelles, their function in integrated cellular metabolism and the molecular interactions between the cells of multicellular organisms. The biochemistry of the cytoskeleton, carriers and intracellular transport systems. The regulation of cellular processes at the molecular endocrine level. Growth and differentiation. Aspects of cancer metabolism, the biochemistry of cell to cell communication and the structure and function of the extracellular matrix. Complementary to BIOS3141 Ultrastructure and Function of Cells and students with a special interest in cell Evolutionary and Functional Biologyare encouraged to take both subjects. Practical work amplifies the lectures.

BIOM9541
Mechanics of the Human Body
Staff Contact: Prof NL Svensson
CP12 SS L2 T1
Prerequisites: BIOM9510 and ANAT2111

Statics and dynamics of the musculoskeletal system: mathematical modelling and computer simulation, analysis of pathological situations.

BIOS1011, 1021, 2011, 2021, 2031, 2051, 2061, 3014, 3061, 3071
Biological Science Registration Centre (for courses in Botany and Zoology)
This will be held in Biology Lab A (room G20, Biological Science building) as follows:

6-10 Feb	10.00-17.00
13-17 Feb	10.00-17.00
20-24 Feb	10.00-17.00

Students must obtain practical slots at that time for:

BIOS 2011	Evolutionary and Physiological Ecology
BIOS 2021	Introductory Genetics
BIOS 2051	Flowering Plants
BIOS 2061	Vertebrate Zoology
BIOS 3071	Conservation Biology and Biodiversity

Pre-enrolment in another faculty does NOT automatically entitle you to a place in your chosen practical time. You must obtain a seat from the Biological Science Registration Centre.

Students enrolling in other subjects do not need to sign on at the Biological Science Registration Centre but only need to attend the first lecture of the relevant course for practical assignments and further details. The location and timetable of lectures and practicals for all subjects in the School of Biological Science (Botany and Zoology) can be obtained from the Biological Science Registration Centre or from the notice boards on the fifth floor of the Biological Sciences Building

Note: Some subjects that appear in this section may be restricted to students for whom the subject comprises a compulsory part of their program.

BIOS1101
Evolutionary and Functional Biology
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: BIOS1021
Note/s: Prerequisites for BIOS1101 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 examines the evolutionary history of life on earth and the relationship between environment, adaptation and function. Animal and plant physiology are covered with an emphasis on adaptation to Australian environmental conditions.

BIOS1201
Molecules, Cells and Genes
Staff Contact; Dr ML Augee
CP15 S2 HPW6
Prerequisite: BIOS1101 or BIOS1021 (Students without this prerequisite may seek the permission of the Director to enrol.)
Note/s: Excluded: BIOS1301 and BIOS1011.

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.

Biological Science Level II

BIOS2011
Evolutionary and Physiological Ecology
Staff Contact: Dr P Steinberg
CP15 S1 HPW6
Prerequisites: BIOS1011 and BIOS1021
Note/s: Students must enrol at the Biological Science Registration Centre, Room G20, Biological Sciences Building. For further details, see Faculty timetable.

Introduction to functional relationships between living organisms and environments in which they live. Emphasis on interactions within and between populations, ecological energies, ecophysiology, and the theory of evolution by natural selection. Plants, animals and microbes are covered. Also serves content as an introduction to the process of scientific enquiry.

BIOS2021
Introductory Genetics
Staff Contact: Dr W Sherwin, Dr A Wilton
CP15 S2 HPW6
Prerequisites: BIOS1011 and BIOS1021
Corequisite: BIOC2201
Note/s: Enrolment in this unit may be subject to quota restrictions. Such restrictions will only apply to students taking this unit as an elective part of their program. Students must enrol at the Biological Science Registration Centre, Room G20, Biological Sciences Building. For further details, see Faculty timetable.

Genome structure and life cycles in prokaryotes and Eukaryotes: DNA, gene mapping, cytogenics. Genetic transmission, mutation, recombination. Gene regulation, interaction and development. Genetic variation and evolution of molecules, populations and species: Mating, selection, migration, population size, mutation, environment. Applications, including humans and genetic engineering.

BIOS2031
Biology of Invertebrates
Staff Contact: A/Prof P Greenaway
CP15 S2 HPW6
Prerequisites: BIOS1011 and BIOS1021
Note/s: Enrolment in this unit may be subject to quota restrictions. Such restrictions will only apply to students taking this unit as an elective part of their program.

A comparative study of morphology, taxonomy, functional biology and evolutionary relationships of invertebrates. Emphasis on major phyla and marine forms. Practical work includes anatomy of living and preserved specimens (including dissections) and a compulsory fieldcamp. Personal expenses will be incurred.

BIOS2051
Flowering Plants
Staff Contact: A/Prof A Ashford
CP15 S2 HPW6
Prerequisites: BIOS1011 and BIOS1021
Note/s: Enrolment in this unit may be subject to quota restrictions. Such restrictions will only apply to students taking this unit as an elective part of their program. Students must enrol at the Biological Science Registration Centre, Room G20, Biological Sciences Building. For further details, see Faculty timetable.

Basic plant biology including cell structure, plant morphology and anatomy, water and sugar transport, seed structure and physiology, plant growth and development arborescence, leaves and photosynthesis, roots, micro-organisms and nutrition, evolution of land plants and plant taxonomy. Practical work: plant anatomy and light microscopy; collection of numerical data and a statistical analysis, plant identification

BIOS2061
Vertebrate Zoology
Staff Contact: Dr M Augee
CP15 S1 HPW6
Prerequisites: BIOS1011 and BIOS1021
Note/s: Excluded 45.301, 17.732. Practical class allocations must be obtained during re-enrolment week from room G20, Biological Science Building. Enrolment in this unit may be subject to quota restrictions. Such

restrictions will only apply to students taking this unit as an elective part of their program.

Comparative study of the Chordata, with particular reference to the vertebrates, including morphology, systematics, evolution and natural history, with reference to selected aspects of physiology and reproduction. Practical work to supplement lectures. 1

The course includes projects or field excursions. Field excursions may incur personal expenses.

BIOS3061
Plant Ecosystem Processes
Staff Contact: Dr R McMurtrie
CP15 S1 HPW6
Prerequisites: BIOS1011 and BIOS102 and any 2 Level II Science subjects

Interactions of plants with their soil and atmospheric environments. Plant growth and decomposition processes. Cycling of carbon, water and nutrients in plant ecosystems. Role of fungi in ecosystems. Mineral nutrition and water uptake in plants. Root systems. Plant strategies for improving mineral nutrition. The role of symbiosis in mineral nutrition. Impacts of global change on vegetation. Role of terrestrial ecosystems in the global carbon budget. Relating vegetation to climate using the BIOCLIM package.

BIOS3071
Conservation Biology and Biodiversity
Staff Contact: Dr W Sherwin
CP15 S1 HPW6
Prerequisites: BIOS1011 and BIOS1021, plus any 2 Level II Biological Science subjects
Note/s: Students must enrol at the Biological Science Registration Centre, Room G20, Biological Sciences Building. For further details, see Faculty timetable.

Applications of community biology, population ecology and genetics to management of environmental problems in nature and artificial ecosystems, including Australian examples. Nature and importance of global diversity, Management and design of programs for the conservation of species and ecosystems, including reserves, off site conservation, and computer simulations. Field excursions compulsory.

BIOS3111
Population and Community Ecology
Staff Contact: A/Prof B Fox
CP15 S2 HPW6
Prerequisites: BIOS1021 and MATH1032 or MATH1231 or MATH1042 or MATH1241 or MATH1021

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

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 53-100, or 3 unit Science 90-150, or 4 unit Science 1-200, or 2 unit Physics 53-100

Stoichiometry and solution stoichiometry. Atomic and molecular structure. Changes of state, phase diagrams, gases, liquids, solids, solutions. Thermodynamics. Equilibrium constants, acid-base and solubility. Oxidation and reduction. Kinetics.

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 two Level I Chemistry units may be counted towards a Science degree.

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.

Stoichiometry and solution stoichiometry. States of matter, changes of state, phase diagrams, gases, liquids, solids, solutions. Thermodynamics, enthalpy, entropy, free energy. Oxidation and reduction, electrode potentials. Kinetics.

CHEM1501
Introductory Chemistry B
Staff Contact: A/Prof B Fox
CP15 S2 HPW6
Prerequisites: BIOS1021 and MATH1032 or MATH1231 or MATH1042 or MATH1241 or MATH1021

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

CHEM1807
Chemistry 1ME
Staff Contact: Dr P Chia
CP15 S1 HPW6
Note/s: excluded CHEM1101, CHEM120. Restricted to Course 3681

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

CHEM2021
Organic Chemistry
Staff Contact: Dr R Read
CP15 S1 or S2 HPW6
Prerequisite: CHEM1101 and CHEM1201

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

CHEM2031
Inorganic Chemistry and Structure
Staff Contact: Dr N Duffy
CP15 S1 or S2 HPW6
Prerequisite: CHEM1101 and CHEM1201

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

CHEM2041
Chemical and Spectroscopic Analysis
Staff Contact: Dr G Moran
CP15 S1 or S2 HPW6
Prerequisites: CHEM1101 and 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.

CHEM2818
Physical Chemistry for Materials Science and Engineering
Staff Contact: Prof R F Howe
S1 or S2 HPW5
Prerequisites: CHEM1101 and CHEM1201 and MATH1042 or MATH1241 or MATH1032 or MATH1231 or MATH1021
Note/s: Excluded 02.022A

First, second and third laws of thermodynamics. Applications of thermodynamics. Chemical and phase equilibria. Solutions of electrolytes and non-electrolytes. Principles and applications of electrochemistry. Reaction kinetics order and molecularity; effect of temperature on reaction rate.

CHEM2819
Physical Chemistry for Food and Fibre Science and Technology
Staff Contact: Prof R F Rowe
CP15 S1 or S2 HPW6
Prerequisites: CHEM1101 and CHEM1201 and MATH1042 or MATH1241 or MATH1032 or MATH1231 or MATH1021
Note/s: Excluded 02.002A

First, second and third laws of thermodynamics. Applications of thermodynamics. Chemical and phase equilibria. Solutions of electrolytes and non-electrolytes. Principles and applications of electrochemistry. Reaction kinetics order and molecularity; effect of temperature on reaction rate. Colloid and surface chemistry; liquid surfaces, surface tension, adsorption, surfactants and detergency, colloidal dispersions and micelles, solid surfaces and adsorption on solids.

CHEM2808
Organic and Inorganic Chemistry for Chemical Engineers
Staff Contact: Dr D Phillips
CP10 S1 HPW4

Discussion of selected types of organic reactions to provide a broad cover of the chemistry of aliphatic and aromatic compounds. Survey of the structures, energetics, bonding, reactions and physical properties, and applications, of selected compounds of main group elements and of lanthanide and dblock transition elements.

CHEM2929
Fundamentals of Biological and Agricultural Chemistry
Staff Contact: Dr P Southwell-Keely
CP15 S1 HPW6

Aspects of the chemical and physical properties of materials important in biological systems. Amino acids, peptides and introduction to protein structure. Chemistry of monosaccharides, disaccharides and polysaccharides. Fats. Trace elements. Common heterocyclic systems of biological importance. Insecticides. Colour. Chromatography.

CHEM3021
Organic Chemistry
Staff Contact: A/Prof M Gallagher
CP15 S1 HPW6
Prerequisite: CHEM2021

Synthesis and reactions of the principal types of aromatic heterocyclic systems. Stereochemistry. Synthesis and reactions of carbocyclic systems. Application of spectroscopic methods, eg nuclear magnetic resonance, mass spectrometry, to determination of organic structures.

CHEM3121
Synthetic Organic Chemistry
Staff Contact: Prof M Paddon-Row
CP15 S2 HPW6
Prerequisite: CHEM3021

Modern functional group transformations with particular reference to positional and stereochemical control. Pericyclic reactions and photochemistry; Woodward-Hoffman rules. Principles of planning organic synthesis; disconnection approach.

CHEM3311
Environmental Chemistry
Staff Contact: Prof R Howe
CP15 S2 HPW6
Prerequisites: CHEM2011, CHEM2041

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

CHEM3321
Applied Organic Chemistry
Staff Contact: A/Prof N Cheetham
CP15 S1 HPW6
Corequisite: CHEM3021

Polymerisation processes and synthetic polymers; initiators, chain transfer agents, retarders. Pigments and dyestuffs; Basis of colour in organic compounds. Oxidation and reduction processes; theory and industrial importance.

CHEM3829
Organic Chemistry
Staff Contact: Prof D Black
CP15 S1 HPW6

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.

CHEM3926
Instrumental Methods of Food Analysis
Staff Contact: A/Prof G Crank
CP7.5

Treatment of theory and practice of modern instrumental methods of analysis, with strong emphasis on the analysis of food constituents. Variety of spectroscopic and chromatographic techniques.

CHEM3929
Food Chemistry
Staff Contact: A/Prof G Crank
CP15

Treatment of the chemistry of important food constituents. Topics include: proteins, carbohydrates, fats and oils, vitamins, natural and synthetic pigments essential oils and flavours, importance of water in foods.

CHEM7325
Toxicology, Occupational and Public Health
Staff Contact: A/Prof G Crank
CP28 F L1 T3

Important classes of toxic materials found in the environment; treatment of pesticide residues, industrial chemicals of various types, toxic gases, mould metabolites and bacterial toxins occurring in food, carcinogenic substances, toxic metals etc. Effects of these substances on living organisms, particularly people. Practical work: pesticide residue analysis, blood and urine analysis, gas sampling and analysis, trace metal determination and experiments on the animal metabolism of toxic substances.

CIVL0616
Structures
Staff Contact: A/Prof V A Pulmano
CP12 S1 L1 T2
Note/s: This is a servicing subject for courses offered by other schools and faculties.

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

CIVL4006
Industrial Training
Staff Contact: Mr G Nawar
CP10

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

CIVL4203
Structural Engineering
Staff Contact: Dr F Barzegar
CP10 S1 L3 T1
Prerequisites: CIVL3203, CIVL3303

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

CIVL4306
Engineering and the Environment
Staff Contact: Mr GR Mostyn
CP10 S1 L2 T2
Prerequisite: CIVL3601

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

CIVL4502
Geotechnical Engineering 2
Staff Contact: Dr G Swarbrick
CP12 S1 L2 T1
Prerequisite: CIVL3402

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

CIVL4605
Water Supply and Wastewater Disposal
Staff Contact: Mr PJ Bliss
CP12 S1 L2 T1
Prerequisite: CIVL2505

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

CIVL4704
Highway and Pavement Engineering
Staff Contact: A/Prof B Shackel
CP12 S1 L2 T1
Prerequisites: CIVL3402, CIVL3804

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

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

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

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

CIVL4906
Project/Thesis
Staff Contact: Dr N Gowripalan
CP17.5.5 S1 1 S2 6
Prerequisites: All third year subjects
Corequisite: The appropriate major

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

CIVL9402
Transport, Environment, Community
Staff Contact: Dr SE Samuels
CP15 F
Note/s: Not offered in 1996

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

CIVL9403
Theory of Land Use Transport Interaction
Staff Contact: Dr SE Samuels
CP12 SS
Note/s: Not offered in 1996

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).

CIVL9405
Urban Transport Planning Practice
Staff Contact: Dr SE Samuels
CP12 SS
Note/s: Not offered in 1996

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.

CIVL9408
Transport Systems Design (Urban)
Staff Contact: Dr SE Samuels
CP12 S1
Types of urban transport facilities. Distributors, streets, bicycle routes, walk-oriented areas, bus lanes and rapid transit lanes, stops and change terminals, noise control. Minimum geometric form; speed range controls, provision for surface water on urban roads, landscape. Design of intersection and parking areas.

CIVL9410
Highway Engineering Practice
Staff Contact: A/Prof B Shackel
CP12 S1

Highway systems and organisation. Roles and interaction of public and statutory highway and transportation authorities and research organisations. Sources and administration of highway finance. Highway programming. Feasibility studies. Engineering investigation and planning of highways and interchanges. Factors affecting long-term performance of transport facilities. Definition of design parameters. Factors of safety.

CIVL9710
Engineering Risk Management
Staff Contact: Mr G Nawar
CP12 S1

Introduction to the concept of risk and decision making under conditions of uncertainty; project objectives and planning, risk/factors affecting project performance; risk identification in engineering processes; human error, natural hazards and unforeseen risks; risk evaluation and quantification methods; relevant statistical techniques; risk avoidance and minimisation; financial risk, portfolio theory,

risk sharing and financing; ambient and acceptable risk levels; insurances.

CIVL9726
Legal Studies and Professional Practice
Staff Contact: Prof DG Carmichael
CP12 SS
Note/s: Not offered in 1996

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.

CIVL9788
Site Investigations
Staff Contact: Prof R Fell
CP12 S1

Engineering geology mapping and terrain classification. Drilling, trenching and sampling of rock and soil. In-situ testing of soil and rock. Laboratory testing of soil and rock. Assessment of design parameters. Instrumentation to measure pore pressure, stress, displacement.

CIVL9790
Stability of Slopes
Staff Contact: Prof R Fell
CP12 S1

Stability of natural and constructed slopes in civil and mining engineering. Stability analysis; stabilisation methods and design; monitoring. Design of slopes in soft ground, soil and rock, and in partially saturated slopes; design of open cut mines. Probabilistic methods.

CIVL9799
Environmental Geomechanics
Staff Contact: Dr GE Swarbrick
CP12 S1

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

CIVL9851
Unit Operations in Public Health Engineering
Staff Contact: Mr PJ Bliss
CP12 S1

Theory of physical, chemical, biological, and hydraulic processes used in both water and wastewater treatment. Applications where these are common to both water and wastewater treatment.

CIVL9855
Water and Wastewater Analysis and Quality Requirements
Staff Contact: Ms PA FitzGerald
CP12 S1

The effects of impurities in water and wastewater on its suitability for various beneficial uses, and methods used for detecting impurities. Analytical methods used in water and wastewater treatment for monitoring and process control.

CIVL9856
Water Treatment
Staff Contact: Ms PA FitzGerald
CP12 S2

Application of processes and process variations used to upgrade the quality of water for specified uses, with particular reference to the treatment of water for municipal use.

CIVL9857
Wastewater Treatment and Disposal
Staff Contact: Mr PJ Bliss
CP12 S2

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

CIVL9858
Water Quality Management
Staff Contact: Prof TD Waite
CP12 S2

Fundamental concepts; systems approach to quality aspects of water resource systems; quality interchange systems; quality changes in estuarine, surface, and ground water. Quality management by engineered systems. Economic and regulatory criteria relating to water use and re-use systems.

CIVL9861
Environmental and Engineering Geophysics
Staff Contact: Dr RI Acworth
CP12 S2

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

CIVL9872
Solid Waste Management
Staff Contact: Mr SJ Moore
CP12 S2

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

CIVL9875
Hydrological Processes
Staff Contact: A/Prof I Cordery
CP12 S1

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

CIVL9876
Water Resource Modelling
Staff Contact: Dr D Djokic
CP12 S1

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

CIVL9880
Groundwater Modelling
Staff Contact: Dr RI Acworth
CP12 SS
Note/s: Not offered in 1996

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

CIVL9881
Hazardous Waste Management
Staff Contact: Mr SJ Moore
CP12 S2

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

CIVL9888
Environmental Management
Staff Contact: Mr SJ Moore
CP12 S1

Spectrum of modern environmentalism and sustainable development; environmental impact statement techniques and EIA procedures; environmental management sysems; 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.

CIVL9890
Spatial Decision Support Systems In Water Resources
Staff Contact: Dr D Djokic
CP12 SS
Note/s: Not offered in 1996

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

CIVL9891
Groundwater Contamination and Remediation
Staff Contact: Dr RI Acworth
CP12 S1

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

CMED9500
Epidemiology
Staff Contact: Dr M McLaws, A/Prof J Kaldor
CP15 S1 HPW3

This subject provides students with an understanding of the role of epidemiology as the quantitative science underpinning much of public health practice. Students will learn the basic methodological tools of epidemiology, such as statistics to measure disease frequency, skills to critically review literature and interpret epidemiological studies, and their application in a variety of research and public health contexts. Skills for measuring frequency of disease and testing for evidence of association between risk factors and disease in this subject will build on statistics learnt in HEAL9061 Statistics for Public Health.

This subject will cover topics pertaining to study design, basic statistical tests and interpretation of results. Application of these topics in areas such as questionnaire design, conducting and managing studies, problems relating to research grants will be covered in CMED9513 Applied Epidemiology.

CMED9519
Demography
Staff Contact: A/Prof I Burnley
CP10 S2 HPW2

Introduction to demography; sources and processing of data, principles and applications. Life tables, mortality, marriage and divorce, natality, reproductivity. Martial characteristics and family groups. Migration. Distribution by area, sex, age, race; educational and economic characteristics. Population estimates and projections. Computer techniques.

CMED9600
Disability
Staff Contact: Dr H Dickson
CP10

Epidemiology of disabling physical and mental conditions; the nature of disability and handicap (including developmental disability); perceptions of handicap; disabled persons' consumer movement and organisation; sociology of disability; social inequality and disability; rehabilitation; community and specialist rehabilitation services; relevant legislation, government services, special needs of disabled persons health accommodation and the physical environment, transport, work, income support, legal rights and public policy.

CMED9604
Tobacco, Alcohol and Other Drug Issues
Staff Contact: A/Prof R Richmond
CP10

Concepts of drug dependence, including pharmacological aspects; management of these problems in primary care; rehabilitation programs, smoking cessation; weight control; social and psychological factors and their impact on the family; drug problems and their impact on the community; public health aspects; population indices and surveillance; control programs; legislation; law enforcement; medical and legal aspects of drug dependence.

CMED9609
Community Genetics
Staff Contact: Dr L Lai
CP10

Brief discussion of essentials of human genetics and new development; role of genetics in community health; individuals at risk; genetic disorders including congenital, chromosomal and single-gene defects; their causes and distribution in different populations; health services comprising genetic counselling, screening, carrier detection, pre-symptomatic diagnosis, prenatal diagnosis, and laboratory investigation, and their planning and funding; support groups as related to types of genetic disorder; basic training of genetics in medicine; education and prevention; social, moral and ethical issues involved in the provision of genetic services.

CMED9612
Environmental Health
Staff Contact: Dr J. Frith
CP10 S2 HPW2 - External mode also available

To introduce the principles of epidemiology, particularly in reference to environmental risk factors of disease and in reference to such principles as incidence and prevalence, aetiology and risk factors, epidemics and endemics, and primary, secondary and tertiary prevention of disease. In particular, it deals with environment and disease, radiation, chemical, hazards, air and water pollution, biological hazards, urban environment, ecology, ecosystems and interdependence and how these factors affect health, public health issues related to sustainable development.

COMP9311
Data Base Systems
Staff Contact: Prof J Hiller
CP12 S1 or S2 HPW3
Assumed knowledge: Familiarity with storage structures
Note/s: Excluded 6.659G, 55.823G

A first subject on data base management systems to be presented at a level appropriate for a graduate subject. The material to be covered will include a selection from: the relational, hierarchic/network, and inverted file data models; normalisation and the problems of redundancies; views and their updates; high level query languages; distributed systems; deductive data bases; object data bases; data definitions; application generators.

ECOH2301
Management Strategy and Business Development
Staff Contact: Dr D Meredith
CP15 S1 HPW3
Prerequisite: ECON1102

This subject focuses on origins, evolution and attributes of modern business enterprise in Australia, Europe, America and Japan; strategy, structure and corporate performance; the economics of organisation and the organisation of work; theory and analysis of multinationals; integration, diversification and the marketing function; managerial hierarchies; decision management and decision control; entrepreneurship; public policy, social responsibility and the external business environment.

ECON1101
Microeconomics 1
Staff Contact: Dr N Warren
CP15 S1 or S2 HPW3
Prerequisite: 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)

This subject introduces economics as a social science: scarcity, resource allocation and opportunity cost; an introductory analysis of consumer behaviour; the economics of firms and markets; production and costs; the classification and analysis of markets; efficiency concepts and market failure; the gains from international trade and the impact of trade restrictions; economic growth and structural change.

ECON1102
Macroeconomics 1
Staff Contact: Dr T Stegman
CP15 S1 or S2 HPW3
Prerequisite: ECON1101

This subject provides an introduction to the analysis of aggregate output, employment and economic growth and their relationship to the policy issues of unemployment, inflation and the balance of payments. Other topics include: social accounting and aggregate income and expenditure analysis; macroeconomic models of income determination; consumption and investment functions; the role of money and financial institutions; interactions between goods and money markets in equilibrium and disequilibrium situations; and an analysis of recent Australian macroeconomic experience.

ECON1103
Microeconomic Principles
Staff Contact: Dr J Lodewijks
CP15 S1 HPW3
Prerequisite: 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)
Note/s: Excluded ECON1101 and ECON1102.

This subject introduces economics as a social science; scarcity, resource allocation and opportunity cost; consumer and producer behaviour as the basis for supply and demand analysis; introduction to marginal analysis; applications of supply and demand analysis; efficiency concepts and market forces.

ECON1104
Macroeconomic Principles
Staff Contact: Dr J Lodewijk
CP15 S2 HPW3
Prerequisite: ECON1103
Note/s: Excluded ECON1101 and ECON1102.

This subject provides and introduction to the analysis of aggregate output, employment and economic growth and their relationship to the policy issues of unemployment, inflation and the balance of payments. Also covered are models of the determination of equilibrium income; an analysis of the role of financial institutions; and an introduction to the analysis of macroeconomic policy.

ECON2103
Business and Government
Staff Contact: A/Prof R Conlon
CP15 S2 HPW3
Prerequisite: ECON1101 or ECON1103
Note/s: Excluded ECON2101

This subject examines how government affects the business environment at the microeconomic level. The case for intervention and the benefits of deregulation and privatisation are analysed, with reference to particular industries. The effects on business of government instrumentalities such as the Industries Commission, Prices Surveillance Authority, Trade Practices Commission and Foreign Investment Review Board are examined. Issues relating to microeconomic reform, economic rationalism, market failure and government business enterprises are explored.

ECON2104
Australian Macroeconomic Policy
Staff Contact: A/Prof G Kingston
CP15 S1 HPW3
Prerequisites: ECON1102 or ECON1104
Note/s: Excluded ECON2102

This subject examines economic growth and fluctuations and the effect this has on the business environment and the community. It explains the main macroeconomic tools and techniques used by governments and the Reserve Bank to implement fiscal, monetary and incomes policies. The implications for inflation, unemployment, interest rates and exchange rates, and foreign debt are discussed.

ECON2108
Industry Economics and Australian Industrial Policy
Staff Contact: Dr R Chapman
CP15 S2 HPW3
Prerequisite: ECON2101 or ECON2103

Topics covered include: structure of industry; inter-relationships between the role of the business firm and industrial structure; multinational corporations; factors affecting size, structure and performance such as economies of scale, barriers to entry, vertical integration, diversification and mergers, patents, the development and transmission of technology; industrial policy in Australia with special reference to competition policy, foreign investment and mergers, and some specific industry policies e.g. on motor vehicles, electronics, steel, petroleum.

ECON2109
Economics of Natural Resources
Staff Contact: Dr G Waugh
CP15 S1 HPW3
Prerequisite: ECON2101 or ECON2103

This subject provides an introduction to the exploitation of natural resource systems examined within an economic framework, particularly forestry, fisheries, water, oil and other minerals. It also looks at policies required to ensure improved management without overexploitation of these renewable and non-renewable resources under different property-right regimes.

ECON2111
The Economics of Global Interdependence
Staff Contact: Dr J Lodewijks
CP15 S2 HPW3
Prerequisite: ECON1102 or ECON1104

Australia is in an interdependent world. Direction and composition of world trade. Trade in services. Trade theory and trade policy. Strategic trade policy and imperfect competition. International competitiveness. Barriers to trade and trading blocs. International institutions and policy. NAFTA,GATT and EU. World Bank and IMF. Foreign currency markets. International policy coordination.

ECON2115
Japanese International Economic Relations
Staff Contact: Dr K Fox
CP15 S2 HPW3
Prerequisite: ECON1102 or ECON1104

Japan's international trade, investment and balance of payments policies, globalisation of Japanese economic interests, problems relating to external economic policies including alternative strategies for international economic relations, impact of yen appreciation, trade friction, bilateral relations with focus on Australia, USA, China and South East Asia.

ECON2116
Japanese Economic Policy
Staff Contact: Dr K Fox
CP15 S1 HPW3
Prerequisite: ECON1102 or ECON1104

Analysis and evaluation of postwar economic policy,issues relating to policy determination including role of institutions and interest groups, critical examination of 'Japan Inc' model, industrial policy and role of

genkyoku' system, Japanese long term economic planning, nature of principle economic policies such as agricultural, monetary and fiscal, anti-trust and competition policies.

ECON2117
Economics of Tourism
Staff Contact: Dr G Waugh
CP15 S1 HPW3
Prerequisites: ECON1102 or ECON1104

Topics include: macro and micro economic environments; factors affecting international and domestic tourism; tourism forecasting models; economic analysis of projects; Cost/benefit and related procedures; and the implications of tourism developments for the community in general.

ECON2127
Environmental Economics and Cost-Benefit Analysis
Staff Contact: Dr G Waugh
CP15 S2 HPW3
Prerequisite: ECON1101 or ECON1103

This subject considers the main elements of environmental economics and cost benefit analysis as it relates to the assessment of environmental issues. Topics include: pollution and pollution policy; environmental cost-benefit analysis and economic methods for measuring costs and benefits; species extinction and irreversibility: environmental ethics and discounting; the environment and developing countries; and the sustainable economy.

ECON3115
Economics of Developing Countries
Staff Contact: Dr J Lodewijks
S1 HPW3
Prerequisite: ECON1102 or ECON1104
Note/s: Not offered in 1995.

ECON5116
Environmental Economics and Cost Benefit Analysis
Staff Contact: Dr G Waugh
S2 L3 CP20
Prerequisite or Corequisite: ECON5100

Main elements of environmental economics and cost benefit analysis as it relates to the assessment of environmental issues. Topics will include: pollution and pollution policy; environmental cost-benefit analysis and economic methods for measuring costs and benefits; species extinction and irreversibility: environmental ethics and discounting; the environment and developing countries; and the sustainable economy.

ELEC0807
Electrical Engineering 1E
Staff Contact: Dr BD Farah
CP7.5 S2 L2 T1
Fundamental concepts in electrical circuits: key theorems, analysis of AC circuits, complex impedance, RLC circuits. Introduction to amplifiers and filters. Functional circuits based on operational amplifiers. Introduction to digital logic, based on integrated circuits. Combinational logic and memory., Electric machines: DC and AC motors. Characteristics of principle types and their applications.

ELEC0808
Electrical Engineering 2E
Staff Contact: Dr BD Farah
CP7.5 S2 L2 T1
Prerequisite: ELEC0807

Signal processing using integrated operational amplifiers, passive components and selected non-linear elements. Procesing data from typical industrial sensors. Digital logic: registers, adders. Serial and parallel data transmission. A/D converters. The architecture of a micorporcessor and an outline of progamd control. Transformers and power supplies. Dynamic characteristics of AC and DC motors. Speed control and principles of servo design.

ELEC9410
Robotics, Automation and Productivity Technology
Staff Contact: A/Prof KE Tait
CP12

Principles of Robotics relevant to trends in automating the manufacturing process. Such aspects as arm configurations, dynamics and control with relevant sensing methods; assembly and control together with trends in artificial intelligence for Robotics are discussed.

GMAT0441
Surveying for Engineers
Staff Contact: A/Prof A Stolz, Dr B R Harvey
CP11.5 S2 L2 T2.5
Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

Principles of surveying; co-ordinate systems, levelling, linear and angular measurement. Traversing, tacheometry and electronic distance measurement. Areas and Volumes. Horizontal and vertical curves. Control, underground and construction surveys. Outline of photogrammetry.

GMAT0580
Mining Surveying
Staff Contact: Mr S Ganeshan
CP7.5 S1 L2 T1
Prerequisite: GMAT0441
Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

Revision of traverse, set out and levelling (14 hours field work).

Surface surveys. Map projections, the Integrated Survey Grid (ISG). 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.

GMAT6532
Spatial Information Systems 1
Staff Contact: Dr E G Masters
CP7.5 S2 L2 T1
Corequisite: GMAT5122

Overview and background of Spatial Information Systems. Explanation of definitions and terminology.Theory and application of SIS technology; digital maps and data base management; data acquisition; data storage, editing, raster and vector representations; topology. Modelling and analysis. Design and development of spatial databases. Use of GIS packages.

GMAT7532
Spatial Information Systems 2
Staff Contact: Ms L Li
CP5 S1 L1 T1
Prerequisite: GMAT6532

Management and appliction of spatial information systems; system lifecycle; costs and benefits. Institutional issues. Data management; land information as maps and records. Existing systems. Future developments..

GMAT9211
Introduction to Geodesy
Staff Contact: A/Prof AHW Kearsley
CP12 S2 L2 T1

Geodesy in the service of mankind. The earth's gravity field. The earth's motion in space. Co-ordinate and time systems used in geodesy. Horizontal and vertical control networks. Earth satellite motion. Principles of satellite positioning. Gravimetric geodesy. Space geodetic methods. Variations of geodetic positions with time.

GMAT9530
Analytical Photogrammetry
Staff Contact: Prof J C Trinder
CP12 SS L2 T1

Fundamental relationship, image and object space. Interior orientation, deviations from collinearity. General orientation of one and two images by collinearity. Simultaneous block adjustment by bundles. Additional parameters. Calibration of metric and non-metric cameras. Control requirements in analytical photogrammetry.

GMAT9532
Data Acquisition and Terrain Modelling
Staff Contact: Prof JC Trinder
CP12 SS L2 T1

Introduction to principles of Computer Assisted Mapping. Collection and editing of feature coded digital terrain data in vector and raster form. Digital elevation models; acquisition, interpolation and processing. Terrain modelling and display. Automation of mapping processes. Archival of digital map data.

GMAT9600
Principles of Remote Sensing
Staff Contact: Prof BC Forster
CP12 S1 L2 T1

History and development. Definition and physics of basic electromagnetic radiation quantities. Basic-energy matter relationship. Spectral signatures of surfaces. Atmospheric considerations and the reduction of atmospheric effects. Sensor concepts including film and electro-optical sensors. An introduction to data processing and enhancement, including image interpretation procedures.

GMAT9602
Remote Sensing Procedures
Staff Contact: School Geomatic Engineering Office
CP12 S2 L2 T1

Review of atmospheric correction procedures and application to multitemporal Landsat MSS data. Review of image registration, enhancement and classification procedures with particular reference to multisource remote sensing data sets. Analysis of techniques over a varied land use area. Land use change project and analysis using multisource and multitemporal remotely sensed imagery, including Landsat MSS, TM, SPOT and SAR.

GMAT9604
Land Information Systems
Staff Contact: Dr EG Masters
CP12 SS L2 T1

Land information as maps and records. Methods of data collection. Integrated surveys and coordinate systems. Legal boundaries. Land tenure. Identifiers. Computerization of land information. Data input methods. Data storage methods. Data processing and manipulation, including management, searching, existing data base languages, and interactive data editing. Data output, including computer graphics, line printer maps, and digital plotters. Application of Arc-Info LIS software.

GMAT9605
Field Data Collection and Integration
Staff Contact: Prof BC Forster
CP12 S1 HPW3

The spectral, temporal and spatial characteristics of various surfaces, and the available sensors to effect maximum differentiation. Ground and image comparisons. Instruments available for field measurements. Field investigation procedures including positioning and sampling considerations.

GMAT9606
Microwave Remote Sensing
Staff Contact: Prof BC Forster
CP12 S1 HPW3

Use of passive and active (radar) microwave techniques in remote sensing of earth resources. Topics include: real and synthetic aperture radar systems; passive microwave radiometry; energy-surface interactions; interpretation of microwave image data: applications in agriculture, geology, oceanography and hydrology; issues in signal and image processing; characteristics of airborne and spaceborne microwave sensors.

GMAT9608
Cadastral Systems
Staff Contact: School Geomatic Engineering Office
CP12 SS L2 T1

The cadastral concept. Cadastral surveying and mapping, land registration, valuation of land, land tenure and land administration. Cadastres and land information systems (LIS). Strategies for improving cadastral systems. Cadastral systems in developing countries; legal, technical, administrative, economic and social issues.

HEAL9371
Research and Evaluation Methods

HEAL9411
Epidemiology for Health Administrators and Planners
Staff Contact: Dr Mary-Louise McLaws
CP15 S1 L2

Principles and methods of epidemiologic investigation of both communicable and noncommunicable diseases including descriptive, analytic and experimental epidemiology. The epidemiology of acute chronic diseases, demography, determination of health status of a defined population, measurement of disease rates and interpretaton. The uses of epidemiology in planning, operation and evaluation of interventions. Epidemiology of staff, hotel services, diagnostic and treatment services.

HEAL9421
Public Health
Staff Contact: Prof James Lawson
CP15 S1 L2

Distribution patterns and determinants of disease and disability with particular reference to diseases of major Australian concern. Preventive, treatment and

rehabilitation strategies. The uses of epidemiology in the planning, operation and evaluation of health services.

INFS1602
Computer Information Systems 1
Staff Contact: School of Information Systems Office
CP15 S1 or S2 HPW 4
Prerequisite: Nil

This subject develops an understanding of the content of information systems, the types of information systems and the position of information systems in society; information systems at an organisational level, typical commercial applications, the systems life cycle, design concepts, data analysis and models and an introduction to data communications.

IROB1701
Industrial Relations 1A
(Australian Industrial Relations)
Staff Contact: Dr B Ellem
CP15 S1 or S2 L2 T1.5
Prerequisite: 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)

This subject provides a multi-disciplinary introduction to a range of important concepts and issues in Australian industrial relations. Topics include: political, social, economic, legal, historical and psychological aspects of the evolution and operation of modern industrial relations; the nature and implications of strikes, lockouts and other forms of industrial conflict and alienation; the structure and policies of State and Federal trade unions, the State labor councils and such peak organisations as the Australian Council of Trade Unions; the employer industrial relations function, management strategies and the structure and policies of employer associations; processes of work rule determination, such as collective bargaining, mediation, conciliation and compulsory arbitration; labour movements; and the role of the various arbitration tribunals and government instrumentalities with respect to industrial relations.

IROB2718
Human Resource Management
Staff Contact: School of Industrial Relations and Organisational Behaviour Office
CP15 S2 L2 T1
Prerequisite: IROB1701

This subject looks at the context of working in Australia. It covers contemporary management thinking; issues in managing people - problem solving, leadership, power, communications and managing in an organisation - group dynamics and supervision, setting goals and performance appraisal, developing individual and organisational resources, career planning.

IROB5701
Australian Industrial Relations
Staff Contact: A/Prof B Dabscheck
CP20 S1 L3

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.

LAND9010
Environmental Heritage Studies
Staff Contact: Ms H Armstrong
CP12

An investigation of the concepts of environmental heritage concerning aspects of landscape architecture and conservation issues. The application of environmental heritage in the fields of planning and design. Investigation of case studies of the natural and cultural environment. Projects to investigate problems of planning and managing heritage environments. Methods of conservation analysis with an emphasis on Australian environments and their history.

LAND9111
Landscape Planning
Staff Contact: Mr D Crawford
CP12 S1 L2 T1

Introduction to the discipline of landscape planning. Explores a range of basic methods and techniques for the collection, analysis, and valuation of landscape resource data. Application of this knowledge in the development of simple landscape planning models. Participation in a planning exercise applying these skills and knowledge using simple computing techniques.

LAND9212
Landscape Planning Methods
Staff Contact: Mr D Crawford
CP12 S2 L2 T1

Examination and comparison of a range of landscape planning methods using examples from Australia and overseas. Students conduct research relating to the physical parameters of models for land use evaluation and environmental impact assessment. Participation in planning exercises involving the application of these models using advanced computing techniques.

LAND9213
Land Systems and Management
Staff Contact: Ms A Todd
CP12 S2 L1 T2

An investigation of resources and their management in relation to a range of land use types with an emphasis on an ecological approach. Subject material includes consideration of management of cultural as well as natural landscapes. Studies of specific examples relating to the effects of human impacts are included. Methods of conservation and rehabilitation are considered. Field excursions are included.

LAND9214
Visual Landscape Assessment
Staff Contact: A/Prof F Thorvaldson
CP12 S2 L2 T1

Examination of visual analysis, assessment and evaluation techniques and their incorporation into landscape planning models. Research and study of recent Australian and overseas examples of visual resource management programs. Students will undertake visual planning exercises using relevant computer software.

LAND9215
GIS in Landscape Architecture
Staff Contact: Mr D Crawford
CP15 S1 L2T1

Principles of geographic information systems, techniques of data collection, storage analysis, modelling and display. Applications and procedures specific to Landscape Architecture and Landscape Planning. Laboratory exercises using the IDRISI GIS.

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, eg, 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 environmental policy will also be considered.

LAWS3410
Environmental Law
Staff Contact: Mr Ross Ramsay
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 employer's common law duty of care; the common law duty of care of manufacturers of products for use at work; the development and application of workers' compensation schemes; existing protective legislation in Australia; individual rights under protective legislation.

LEGT7711
Legal Environment of Commerce
Staff Contact: School of Legal Studies and Taxation Office
CP15 S1 or S2 L2 T1
Prerequisite: 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)

This subject examines the nature and role of law; the Australian legal system; Commonwealth/State relations; Parliament and statute law; the courts and case law; the executive and administrative law; the legal process and its alternatives. This subject also introduces areas of substantive law relevant to commerce with particular reference to property including intellectual property, crime, torts with particular reference to negligent misstatement, employment, commercial entities and transactions, competition and consumer protection.

LEGT7731
Marketing and Distribution Law (formerly Legal Regulation of Marketing and Distribution)
Staff Contact: School Legal Studies and Taxation Office
CP15 S2 L2 T1
Prerequisite: Nil

This subject examines the legal framework of marketing and distribution; restrictive trade practices implications of distribution with special reference to collusive activity, exclusive dealing, resale price maintenance and abuse of market power; consumer protection and fair trading implications of sales promotion with particular reference to misleading or deceptive conduct and other unfair practices; advertising self regulation; product liability; protection of intellectual property; franchising, licensing and character merchandising.

MANF0420
Production Management
Staff Contact: Dr K Hoang
CP15 S1 HPW6
Note/s: Excluded MANF4420
Manufacturing industry dynamics. Porters Model; bases for competition. Meaning of waste; value adding management. Dynamics of materials flow. Hierarchical planning; MRP; OPT; JIT; maintenance management. Manufacturing performance monitoring.

MANF9400
Industrial Management
Staff Contact: Dr B Kayis
CP12 SS HPW3

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

MANF9410
Total Quality Management
Staff Contact: Dr B Kayis
CP12 SS HPW3

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

MARK2012
Marketing Fundamentals
Staff Contact: School of Marketing Office
CP15 S1 L2 T2
Prerequisites: ACCT1511, ECON1102, ECON1203
Corequisite: MARK2032

This subject provides a conceptual framework for developing and understanding of marketing including the marketing process, marketing environment and marketing planning. It covers product, service, consumer, industrial, global and social aspects of marketing and introduces the marketing mix, market segmentation, positioning and product differentiation.

MARK2052
Marketing Research
Staff Contact: School of Marketing Office
CP15 S2 L2 T2
Prerequisite: MARK2012, MARK2032

This subject examines the sources and types of marketing information relevant to marketing management. Topics include: problem definition and research design; questionnaire design; sampling; data collection; interpretation and reporting; management control of research including briefing, evaluation of proposals and distinction between research results and marketing implications; the use of continuous research; and new developments in market research.

MARK3043
International Marketing
Staff Contact: School Office
S2 L2 T1 CP15
Prerequisites: MARK2042 or MARK2052

Conceptual and environmental aspects of international marketing are dealt with. Using this knowledge, issues associated with developing practical marketing strategies appropriate to different world markets are then considered in detail.

MARK3073
Brand Management
Staff Contact: School of Marketing Office
CP15 S1 L2 T2
Prerequisite: MARK2012, MARK2042

This subject provides an overview of marketing planning for products and services with a focus on planning at the brand level. Marketing concepts such as segmentation, differentiation, positioning and product lifecycle will be re-examined from a strategic perspective. The marketing mix will be expanded to address strategies of new product development, pricing, distribution and promotions management. Case analysis will be introduced to develop strategic thinking.

MARK3083
Strategic Marketing Management
Staff Contact: School of Marketing Office
CP15 S2 L2 T2
Prerequisite: MARK3073

Concepts introduced in previous subjects will be broadened to address issues at the business unit level. Corporate mission, competitive stance of the organisation, pricing policies, trade relations, internal marketing and logistics will be addressed. The management of organisational resources such as financial and human resources are considered using, for example, portfolio analysis. Decision support systems are also examined.

MATH1011
General Mathematics 1B
Staff Contact: School of Mathematics First Year Office
CP15 CP15 S1 HPW6
Prerequisites: HSC mark range required: 2 unit Mathematics (60-100) or 2 and 3 unit Mathematics (1-150) or 3 and 4 unit Mathematics (1-200) (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 MATH1032, MATH1042, MATH1131, MATH1141, ECON1202, ECON2200, ECON2201, ECON2202, ECON2290, ECON2291

Functions (and their inverses), limits, asymptotes, continuity; differentiation and applications; integration, the definite integral and applications; inverse trigonometric functions; the logarithmic and exponential functions and applications; sequences and series; mathematical induction; the binomial theorem and applications; introduction to probability theory; introduction to 3-dimensional geometry; introduction to linear algebra.

MATH1021
General Mathematics 1C
Staff Contact: School of Mathematics First Year Office
CP15 CP15 S2 HPW6
Prerequisite: MATH1011 or MATH1131 or MATH1141
Note/s: Excluded MATH1032, MATH1042, MATH1231, MATH1241, ECON2200, ECON2201, ECON2202, ECON1202, ECON2290, ECON2291

Techniques for integration, improper integrals; Taylor's theorem; first order differential equations and applications;

introduction to multivariable calculus; conics; finite sets; probability; vectors, matrices and linear equations.

MATH1032
Mathematics 1
Note/s: No longer offered. Replaced by the two subjects MATH1131 Mathematics 1A and MATH1231 Mathematics 1B

MATH1042
Higher Mathematics 1
Note/s: No longer offered. Replaced by the two subjects MATH1141 Higher Mathematics 1A and MATH1241 Higher Mathematics 1B

MATH1131
Mathematics 1A
Staff Contact: School of Mathematics First Year Office
CP15 S1 or S2 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 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 exam score 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.

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: Mathematics MATH2021 is included for students desiring to attempt only one Level II Mathematics subject. If other Level II subjects in Pure Mathematics or Applied Mathematics are taken, MATH2021 Mathematics is not counted. 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

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 Stokes' theorems. Curvilinear coordinates.

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. Bessel's equation and Legendre's equation. Partial differential equations: characteristics, classification, wave equation, heat equation, Laplace's equation, separation of variables methods, applications of Bessel functions and Legendre polynomials.

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.

MATH2869
Statistics SC
Staff Contact: School Office
CP5 S1 HPW2
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241

Introduction to probability. Random variables. Elementary distribution. Statistical inference. Point estimation. Confidence intervals.

MATH3021
Mathematics 3
Staff Contact: School of Mathematics Office
CP15 F HPW2
Prerequisite: MATH2021
Note/s: Excluded any other Level III subject in Pure Mathematics or Applied Mathematics except for MATH3261. Taught by the Keller plan self-paced learning method.

Vector calculus; special functions; convolution theorem and applications; complex variable theory; Fourier integrals; Laplace transforms with application to ordinary and partial differential equations.

MATH3030
Mathematics 3, Part 1
Staff Contact: School of Mathematics Office
CP7.5 S2 HPW2
Prerequisite: MATH2021
Note/s: Excluded MATH3021.

This subject is the first half of MATH3021. No mark will be returned for this subject until MATH3040 is also completed. All students will receive a grade of EC (enrolment continuing) for this subject, which will eventually be replaced by a mark when MATH3040 is completed.

MATH3040
Mathematics 3, Part 2
Staff Contact: School of Mathematics Office
CP7.5 S1HPW2
Prerequisite: MATH3030
Note/s: Excluded MATH3021.

This subject is the second half of MATH3021. The student must have been enrolled in MATH3030 previously and have a grade of EC in that subject. On completion of MATH3040 a grade will be returned for both MATH3030 and MATH3040.

MECH0130
Engineering Drawing and Solid Modelling
Staff Contact: Dr RA Platfoot
CP10 SS L1 T3
Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

Communication of form and layout of real world objects, solid modelling of objects. Engineering drawing layouts, orthogonal projections, dimensioning, tolerancing and standard drawing symbols, principles of detail design drawings and assembly drawings. Use of computer graphics and production

MECH0330
Engineering Mechanics
Staff Contact: A/Prof RAJ Ford
CP10 SS L2 T2
Prerequisites: As for MECH1300 Engineering Mechanics 1
Note/s: Excluded MECH0360, MECH1300. This is a servicing subject taught within courses offered by other schools and faculties.

Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames and beams. Simple states of stress. Statics of fluids. Rectilinear motion, curvilinear motion using rectangular and natural co-ordinates. Simple rotation. Equations of motion. Work, energy and power. Impulse and momentum.

MECH0440
Engineering Statics
Staff Contact: A/Prof RAJ Ford
CP7.5 SS L2 T1
Prerequisites: As for MECH1300 Engineering Mechanics 1.
Note/s: Excluded MECH0330, MECH0360, MECH1300.

Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames and beams. Simple states of stress. Statics of fluids.

MECH1110
Graphical Analysis and Communication
Staff Contact: Mr AJ Barratt
CP7.5 S2 L1 T2
Note/s: Excluded MECH0130.

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

MECH1300
Engineering Mechanics 1
Staff Contact: Prof EJ Hahn
CP10 S1 or CP10 S2 L2 T2
Prerequisite: HSC Exam Score Range Required - Either 2 unit Science (Physics) 53-100, or 3 unit Science 90-150, or 4 unit Science multistrand, 1-50 or 2 unit Industrial Arts (Engineering Science) 53-100, or 3 unit Industrial Arts (Engineering Science) 1-50.
Corequisite: MATH1032 or MATH1131 or MATH1042 or MATH1141.
Note/s: Excluded MECH0330. Students can make up for the lack of the prerequisite by work taken in Physics in Session I of the first year and enrol in the subject in Session 2.

Vectors, resultants, equilibrium. Systems of co-planar multiforce members. Mass centre, centroids, distributed forces. Friction. Applications to cables, screw threads, clutches etc. Plane particle kinematics: rectilinear, curvilinear and relative motion. Plane particle kinetics: equations of motion, work, energy, power, impulse, momentum, impact.

MECH2300
Engineering Mechanics 2A
Staff Contact: Dr SS Leong
CP7.5 S1 or CP7.5 S2 L2 T1
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, MECH1300 or MECH0360
Note/s: Excluded MECH0430

Kinetics of systems of particles; steady mass flow. Plane kinematics and kinetics of rigid bodies: moment of inertia; motion relative to translating and rotating frames of reference; equations of motion; work and energy, impulse and momentum. Virtual work for static and dynamic systems. Engineering applications.

MECH2310
Engineering Mechanics 2B
Staff Contact: Prof KP Byrne
CP5 S1 or S2 HPW2
Corequisite: MECH2300

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

MECH2600
Fluid Mechanics 1
Staff Contact: A/Prof JA Reizes
CP10 F L1 T1
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, PHYS1919

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

MECH2700
Thermodynamics 1
Staff Contact: A/Prof E Leonardi
CP10 F L1 T1
Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, PHYS1919

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

MECH9325
Fundamentals of Noise
Staff Contact: Dr JM Challen
CP12 SS HPW3
Note/s: Excluded MECH4321, MECH9321

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

MECH9326
Advanced Noise
Staff Contact: Dr JM Challen
CP12 SS HPW3
Prerequisite: MECH4321 or MECH9321 or MECH9325
Note/s: Excluded MECH4322, MECH9322

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

MECH9400
Mechanics of Fracture and Fatigue
Staff Contact: Dr K Zarrabi
CP12 SS HPW3
Note/s: Excluded MECH4400.

Theories of fracture; failure modes. Ductile, brittle fracture. Mechanics of crack propagation, arrest. Measurement of static fracture properties. Fatigue crack initiation, propagation. Engineering aspects of fatigue.

MEED9102
Educational Process in Small Groups
Staff Contact: Prof A Rotem
CP10 S1 HPW2

How people operate as members and leaders of groups; conditions underlying effective group work in educational planning, teaching and learning, and the provision of health care; basic concepts of group structure. Stress on experiential learning, observation of group process, improving skills in facilitating group learning and designing appropriate learning activities.

MEED9108
Program Evaluation and Planned Change
Staff Contact: Prof A Rotem
CP10 S2 HPW2

Designed to help participants develop skills in planning, conduct and evaluation of educational programs. Includes: preparation of a detailed proposal for evaluation of a program; various decisions and activities undertaken in program evaluation; processes of innovation and change.

MEED9125
Planning, Conducting and Evaluating Educational Workshops
Staff Contact: A/Prof R Bandaranayake
CP10 S1 HPW2

In an attempt to develop their skills in all aspects of conducting workshops, participants are guided to formulate a plan for a workshop for their colleagues in an important educational area, with opportunity to practise various techniques for enhancing active participation, and subsequently to conduct the workshop, evaluate its process and outcomes, and report on it.

MICR2201
Introductory Microbiology
Staff Contact: Dr I Couperwhite
CP15 S1 HPW6

This introduction to microbiology is offered as a single unit elective. However, the subject is mandatory for students wishing to major in program 4400 Microbiology and Immunology. Students with no previous knowledge of biology can do this subject. A brief bridging course is available for students in this category.

MICR2218
Microbiology
Solely for students enrolled in the Food Technology BSc courses 3060 and 3070 in the Faculty of Applied Science.

MICR3041
Immunology I
Staff Contact: Prof G Jackson
CP15 S1 HPW6
Prerequisite: BIOC2312

Basic immunology and immunological techniques. Topics include innate and adaptive immunity, development of the immune system, induction and expression of the immune response, structure and function of antibodies, antigen-antibody reactions, the major histocompatibility complex, aspects of immunology in disease. ANAT2211 Histology 1 at Level II is strongly recommended for students doing Immunology I.

MICR3051
Immunology 2
Staff Contact: Dr A Collins
CP15 S2 HPW6
Prerequisite: MICR3041

Advanced immunology. Major topics include antigen epitope analysis, processing and presentation, lymphocyte biology, immunogenetics of the molecules of recognition, cytokines, immune regulation, the mucosal immune system, immunity to infectious diseases, vaccine development and clinical immunology.

MICR3071
Environmental Microbiology
Staff Contact: Prof S Kjelleberg
CP15 S2 HPW6
Prerequisite: MICR2011

Major topics include water quality, the complexity of natural habitats, interaction of micro-organisms with their environment with an emphasis on evolution and adaptation,biogeo-chemical cycling, environmental monitoring in aquatic and soil habitats, manipulation of microbial populations in natural habitats including problems with the release of genetically engineered micro-organisms, and environmental biotechnology.

MNGT0373
Organisational Design
CP10
Prerequisite: MNGT0270 or consent of instructor

Extends the structural analysis of organisations introduced in MNGT0270 or equivalent. Topics include power, informal organisation, management-by-objectives, entrepreneurship, compliance systems and structural change dynamics. Situational factors considered include the product life cycle and technology. Problems discussed include oligarchy, difficulties flowing from large size and from capital intensive, vertical integration.

MSCI3001
Physical Oceanography
Staff Contact: Dr P Dixon
CP15 S2 HPW
Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241
Note/s: Laboratory and fieldwork.

The physical properties and motions of the oceans, and their measurement, oceanographic instrumentation. The design of small and large scale ocean experiments.

PHPH5461
Principles of Pharmacology
Staff Contact: Dr. M Fryer
CP32 S1 5 S2 3

This course introduces the principles of pharmacology and also covers the systematic pharmacology of selected drug groups. It is designed for students with a background in biotechnology but with little or no knowledge of pharmacology. The course covers topics such as dose response relationships, drug absorption, metabolism and elimination, autonomic pharmacology, autacoids, pharmacokinetics and toxicology.

PHPH5471
Advanced Pharmacology
Staff Contact: Dr M Fryer
CP24
Prerequisites: PHPH3152, PHPH5461

This course is an advanced coverage of pharmacological topics including receptor binding, pharmacokinetics, drug assays, drug development, toxicology, autacoids and ion channels. The lecture material is supplemented by computerized analysis of data derived from experiments on receptor binding, dose response relationships and pharmacokinetics. Considerable emphasis is placed on the many aspects of drug development.

PHPH5481
Advanced Pharmacology - Project Major
Staff Contact: Dr M Fryer
CP64

A laboratory or industry based project in the area of drug development.

PHPH5491
Advanced Pharmacology - Project Minor
Staff Contact: Dr M Fryer
CP32

A small laboratory or industry based project or an extensive literature review or extensive data analysis in the area of drug development.

PHYS1022
Physics 1 For Health and Life Scientists
Staff Contact: First Year Director School of Physics
CP30 F HPW6
Corequisites: MATH1021 or MATH1032 or MATH1131.

Principally for students majoring in the life and health sciences disciplines. Topics at an introductory level.

The methods of physics, describing motion, the dynamics of a particle, conservation of energy, kinetic theory of gases, properties of liquids, vibrations and waves, electricity and conduction in solids, ions and ionic conduction, magnetism and electromagnetic induction, alternating current, atomic nature of matter, X-rays, the nucleus and radio-activity, geometrical optics, optical instruments, wave optics, microscopes and their uses.

PHYS1011
Physics 1 (FT1)
Staff contact: First Year Director School of Physics
CP15 S2 HPW6
Prerequisites, Corequisites and Syllabus: Identical to PHYS1002, S1

PHYS1021
Physics 1 (FT2)
Staff contact: First Year Director School of Physics
CP15 Summer Session HPW9
Prerequiste: PHYS1011

Syllabus identical to PHYS1002, S2

PHYS1002
Physics 1
Staff Contact: First Year Director School of Physics
CP30 F 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 (for PHYS1002 only) MATH1011, and 2 unit Science (Physics) 57-100, or 2 unit Science (Chemistry) 60-100, or 3 unit Science 90-150, or 4 unit Science 1-50 or PHYS1022 (2 unit Mathematics in this instance refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics subject, and does not refer to the subjects Mathematics in Society or Mathematics in Practice).
Corequisite: MATH1021 or MATH1032 or MATH1131 and MATH1231.

Motion of particles under the influence of mechanical, electrical, magnetic and gravitational forces. Force, inertial mass, energy, momentum, charge, potential, fields. Conservation principles applied to problems involving charge, energy and momentum. Application of Kirchoff's laws to AC and DC circuits. Uniform circular motion, Kepler's laws and rotational mechanics. Properties of matter: solids, liquids, gases. Application of wave theories to optical and acoustical phenomena such as interference, diffraction and polarisation.

Mid-year Start

Students who fail Session 1 of PHYS1002 are strongly advised to discontinue the subject and enrol in Session 2 in PHYS1011 Physics I (FT1). This subject covers the Session 1 material of PHYS1002 during Session 2. Then PHYS1021 covers the rest of the syllabus over the Summer Session.

Note: The Session 2 syllabus of PHYS1002 is not repeated in Session 1 of the next year.

PHYS1939
Physics 1 (Building and Industrial Design)
Staff Contact: First Year Director School of Physics
CP10
Note/s: Not re-run in Summer Session

Energy transfer: concepts of temperature and heat; calorimetry; gas laws; phase changes and humidity; heat transmission; refrigeration. Electrostatics and electromagnetism: electric and magnetic fields; DC circuits; electromagnetic induction. Sound: wave properties; absorption of sound. Properties of matter: atomic bond types and their relation to elasticity, plasticity and fracture; pressure in stationary and moving fluids.

PHYS1949
Physics 1 (EE, FT1)
Staff contact: First Year Director School of Physics
CP15 S2 HPW6
Prerequisites, corequisites and syllabus: identical to PHYS1969, S1.

PHYS1959
Physics 1 (EE, FT2)
Staff contact: First Year Director School of Physics
CP15 Summer Session HPW9
Prerequisites: PHYS1949

Syllabus identical to PHYS1969, S2.

PHYS2001
Mechanics, and Computational Physics
Staff Contact: Executive Assistant School of Physics
CP15 S1 HPW4
Prerequisites: PHYS1002, MATH1032 or MATH1231.
Corequisite: MATH2100
Note/s: Excluded PHYS2999.

Harmonic motion, systems of particles, central force problems, Lagrange's equations, coupled oscillations, travelling waves, pulses, energy and momentum transfer, computer operating systems, introduction to FORTRAN, libraries and software packages, use of computers to solve problems in physics.

PHYS2011
Electromagnetism and Thermal Physics
Staff Contact: Executive Assistant School of Physics
CP15 S2 HPW4
Prerequisites: PHYS1002, MATH1032 or MATH1231
Corequisites: MATH2100
Note/s: Excluded PHYS2999.

Electric field strength and potential, Gauss' law, Poisson's and Laplace's equations, capacitance, dielectrics and polarisation, magnetism, electro-magnetic induction, Maxwell's equations, electromagnetic waves. Laws of thermodynamics, kinetic theory, microscopic processes, entropy, solid state defects, Helmholtz and Gibbs functions,

Maxwell's relations, phase diagrams, chemical and electrochemical potential.

PHYS2021
Quantum Physics and Relativity
Staff Contact: Executive Assistant School of Physics
CP15 F HPW2
Prerequisites: PHYS1002, MATH1032 or MATH1231
Note/s: Excluded PHYS2989.

Wave-particle duality. Operators, postulates of quantum mechanics. Applications: steps, barriers and tunnelling. H atom. Orbital, spin angular momentum, magnetic moment. Spin orbit interaction. Molecules, LCAO, rotation and vibration. Introduction to statistical mechanics. The nucleus: properties, forces, models, fission and fusion. Special theory of relativity, simultaneity, time dilation, length contraction, momentum and energy.

PHYS2031
Laboratory
Staff Contact: Executive Assistant School of Physics
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 (Applied Science)
Staff Contact: Executive Assistant School of Physics
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.

PHYS3021
Statistical Mechanics and Solid State Physics
Staff Contact: Executive Assistant School of Physics
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.

PHYS3060
Advanced Optics
Staff Contact: Executive Assistant School of Physics
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 School of Physics
CP7.5 S1 HPW4
Prerequisite: PHYS2031

Selected experiments and projects. Advanced experimental techniques and open ended projects in the areas covered in PHYS3041 Experimental Physics A together with projects involving electron and nuclear magnetic resonances, low temperature physics and super-conductivity. Fourier optics, holography.

PHYS3120
Experimental Physics B2
Staff Contact: Executive Assistant School of Physics
CP7.5 S2 HPW4
Prerequisite: PHYS2031

As for PHYS3110 Experimental Physics B1.

PHYS3410
Biophysics
Staff Contact: Executive Assistant School of Physics
CP7.5 S2 HPW2
Prerequisites: PHYS2011, PHYS2410

Physics of self-assembling systems, cellular ultrastructure. Thermodynamics of irreversible processes, application to life processes. Thermodynamical description of ecological associations. Structure of proteins and other macromolecules. Physics of nerve and muscle.

PHYS3710
Lasers and Applications
Staff Contact: Executive Assistant School of Physics
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.

PROF0003
Qualitative Research Methods
Staff Contact: To be advised
CP15 SS HPW2

This subject introduces students to the nature of, and methods for conducting naturalistic inquiry. Topics include the naturalistic research approach, naturalistic research questions, the naturalistic research process, qualitative data collection and analysis methods, qualitative program evaluation.

SCTS3106
Technology, Sustainable Development and the Third World
Staff Contact: John Merson
CP15 S1 HPW3
Prerequisite: As for SCTS2106
Note/s: Excluded 62.082, 62.282, 62.206U, SCTS3001.

This subject is about sustainable development along with the technological and social changes that are involved in achieving it, both at a national and global level. It is divided into three parts: (1) the historical causes of the present

global environmental and economic crisis; (2) possible solutions to problems of food production, environmental degradation, industrialisation, energy use, and population growth; (3) ideas for a New World Economic Order and the economic and technological changes required to bridge the ever increasing gap between rich and poor nations. Assessment: Essay, tutorials.

SCTS3116
The Political Economy of Energy and Sustainable Development
Staff Contact: Gavan McDonell
CP15 S2 HPW3
Prerequisite: As for SCTS2106
Note/s: Subject not offered in 1996. Excluded 62.222U, SCTS3011.

Assessment: Essays, tests, tutorials.

SCTS5303
Knowledge, Power and Public Policy

SCTS5309
Analysing Environmental and Technological Controversies

Conditions for the Award of Degrees

First Degrees

Rules, regulations and conditions for the award of *first degrees* are set out in the appropriate **Faculty Handbooks.**

For the full list of undergraduate courses and degrees offered see Table of Courses by Faculty (Undergraduate Study) in the *Calendar.*

The following is the list of *higher degrees, graduate diplomas and graduate certificates* of the University, together with the publication in which the conditions for the award appear.

Higher Degrees

For details of graduate degrees by research and course work, arranged in faculty order, see *UNSW Courses (by faculty)* in the *Calendar.*

Title	Abbreviation	Calendar/Handbook
Higher Degrees		
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Education	EdD	Professional Studies
Doctor of Juridical Science	SJD	Law
Doctor of Medicine	MD	Medicine
Doctor of Philosophy	PhD	Calendar and all handbooks
Master of Applied Science	MAppSc	Applied Science
Master of Architecture	MArch	Built Environment
Master of Archives Administration	MArchivAdmin	Professional Studies
Master of Art	MArt	College of Fine Arts
Master of Art Administration	MArtAdmin	College of Fine Arts
Master of Art Education	MArtEd	College of Fine Arts
Master of Art Education(Honours)	MArtEd(Hons)	College of Fine Arts
Master of Arts	MA	Arts and Social Sciences University College
Master of Arts (Honours)	MA(Hons)	Arts and Social Sciences
Master of Art Theory	MArtTh	College of Fine Arts
Master of Biomedical Engineering	MBiomedE	Engineering

Title	Abbreviation	Calendar/Handbook
Master of Building	MBuild	Built Environment
Master of the Built Environment	MBEnv	Built Environment
Master of the Built Environment (Building Conservation)	MBEnv	Built Environment
Master of Business Administration	MBA	AGSM
Master of Business Administration (Executive)	MBA(Exec)	AGSM
Master of Business and Technology	MBT	Engineering
Master of Chemistry	MChem	Science*
Master of Clinical Education	MClinEd	Medicine
Master of Commerce (Honours)	MCom(Hons)	Commerce and Economics
Master of Commerce	MCom	Commerce and Economics
Master of Community Health	MCH	Medicine
Master of Community Paediatrics	MCommPaed	Medicine
Master of Computational Science	MComputationalSc	Science
Master of Computer Science	MCompSc	Engineering
Master of Construction Management	MConstMgt	Built Environment
Master of Couple and Family Therapy	MCFT	Professional Studies
Master of Defence Studies	MDefStud	University College
Master of Design(Honours)	MDes(Hons)	College of Fine Arts
Master of Education	MEd	Professional Studies
Master of Education in Creative Arts	MEdCA	Professional Studies
Master of Education in Teaching	MEdTeach	Professional Studies
Master of Educational Administration	MEdAdmin	Professional Studies
Master of Engineering	ME	Applied Science Engineering University College
Master of Engineering without supervision	ME	Applied Science Engineering
Master of Engineering Science	MEngSc	Engineering Applied Science University College
Master of Environmental Engineering Science	MEnvEngSc	Engineering
Master of Environmental Studies	MEnvStudies	Applied Science
Master of Equity & Social Administration	MEqSocAdmin	Professional Studies
Master of Fine Arts	MFA	College of Fine Arts
Master of Health Administration	MHA	Professional Studies
Master of Health Personnel Education	MHPEd	Medicine
Master of Health Planning	MHP	Professional Studies
Master of Higher Education	MHEd	Professional Studies
Master of Industrial Design	MID	Built Environment
Master of Information Management	MIM	Professional Studies
Master of Information Science	MInfSc	Engineering
Master of International Social Development	MIntSocDev	Professional Studies
Master of Medicine	MMed	Medicine
Master of Landscape Architecture	MLArch	Built Environment
Master of Landscape Planning	MLP	Built Environment
Master of Laws	LLM	Law
Master of Librarianship	MLib	Professional Studies
Master of Management Economics	MMgtEc	University College
Master of Mathematics	MMath	Science*
Master of Medicine	MMed	Medicine
Master of Mining Management	MMinMgmt	Applied Science
Master of Music	MMus	Arts and Social Sciences
Master of Music (Honours)	MMus(Hons)	Arts and Social Sciences
Master of Music Education (Honours)	MMusEd(Hons)	Arts and Social Sciences
Master of Optometry	MOptom	Science*
Master of Policy Studies	MPS	Arts and Social Sciences
Master of Project Management	MProjMgt	Built Environment
Master of Public Health	MPH	Medicine Professional Studies

Title	Abbreviation	Calendar/Handbook
Master of Psychological Medicine	MPM	Medicine
Master of Psychology (Applied)	MPsychol	Science†
Master of Psychology (Clinical)	MPsychol	Science†
Master of Real Estate	MRE	Built Environment
Master of Real Property	MRProp	Built Environment
Master of Safety Science	MSafetySc	Applied Science
Master of Science	MSc	Applied Science Built Environment Engineering Medicine Science*† University College
Master of Science without supervision	MSc	Applied Science Built Environment Engineering
Master of Science (Industrial Design)	MSc(IndDes)	Built Environment
Master of Social Work	MSW	Professional Studies
Master of Sports Science	MSpSc	Professional Studies
Master of Sports Medicine	MSpMed	Medicine
Master of Statistics	MStats	Science*
Master of Surgery	MS	Medicine
Master of Taxation	MTax	ATAX
Master of Town Planning	MTP	Built Environment
Master of Urban Development and Design	MUDD	Built Environment

Graduate Diplomas

Graduate Diploma	GradDip	AGSM Applied Science Architecture Arts and Social Sciences Commerce and Economics Engineering Medicine Professional Studies Science*†
	GradDipArts	Arts and Social Sciences
	GradDipC/F Therapy	Professional Studies
	GradDipClinEd	Medicine
	GradDipCommPaed	Medicine
	GradDipEq&SocAdmin	Professional Studies
	GradDipHEd	Professional Studies
	GradDipHPEd	Medicine
	GradDipIndMgt	Engineering
	GradDipIntSocDev	Professional Studies
	GradDipMus	Arts and Social Sciences
	GradDipPaed	Medicine
	GradDipSpMed	Medicine
	DipEd	Professional Studies
	GradDipIM-Archiv/Rec	Professional Studies
	GradDipIM-Lib	Professional Studies
	DipFDA	Science*†

Graduate Certificates

	Grad	
	GradCertHealthAdmin	Profeessional Studies
	GradCertHEd	Professional Studies

**Faculty of Science.*
†Faculty of Biological and Behavioural Sciences.

Doctor of Philosophy (PhD)

1. The degree of Doctor of Philosophy may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty or board (hereinafter referred to as the Committee) to a candidate who has made an original and significant contribution to knowledge.

Qualifications

(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 cosupervisor 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 cosupervisor 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.

**'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 interdisciplanary unit within a faculty and under the control of the Dean of the Faculty. Enrolment is permitted in more than one such teaching unit.*

(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 reexamination.

(e) The thesis does not merit the award of the degree and does not demonstrate that resubmission would be likely to achieve that merit.

(3) If the performance at the further work recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to represent the same thesis and submit to further examination as determined by the Committee within a period specified by it but not exceeding eighteen months.

(4) The Committee shall, after consideration of the examiners' reports and the results of any further work, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate be permitted to resubmit the thesis after a further period of study and/or research.

Fees

7. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Applied Science (MAppSc) and Master of Environmental Studies (MEnvStudies)

1. The degree of Master of Applied Science or Master of Environmental Studies by formal course work may be awarded by the Council to a candidate who has satisfactorily complete a program of advanced study.

Qualifications

2. (1) A candidate of the degree shall:

(a) have been awarded an appropriate degree of Bachelor of four full-time years duration (or the part-time equivalent) 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 Applied Science (hereinafter referred to as the Committee), or

(b)(i) have been awarded an appropriate degree of Bachelor of threefull-time years duration (or the part-time equivalent) from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee and

(ii) have undertaken appropriate postgraduate studies of the full-time year's duration (or the part-time equivalent) at the University of New South Wales or studies 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 attainments as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the degree shall be required to undertake such formal subjects including the submission of a report on a project, and pass such assessment as prescribed. The project shall be under the supervision of an academic staff member and shall be assessed by two examiners (for a major project).

(3) The progress of a candidate shall be reviewed at least once a year 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 and 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, eight sessions for a part-time candidate, and ten sessions for an external 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 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 the recommendation of the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee) to a candidate who as demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the degree.

(3) When the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant, before being permitted to enrol, to undergo such examination or carry out such work as the Committee may prescribe.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one calendar month before the commencement of the session in which 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 (or department) 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 has had previous research experience the Committee may approve remission of up to one session for a full-time candidate and two sessions for a part-time or external candidate.

(8) A full-time candidate for the degree shall present for examination not later than six academic sessions from the date of enrolment. A part-time or external candidate for the degree shall present for examination not later than ten academic sessions from the date of enrolment. In special cases an extension of these times may be granted by the Committee.

Thesis

4. (1) On completing the program of study a candidate shall submit a thesis embodying the results of the original investigation.

(2) The candidate shall give in writing two months notice of intention to submit the thesis.

(3) The thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses.

(6) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

Examination

5. (1) There shall be not fewer than two examiners of the thesis, appointed by the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this 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 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.

(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 represent the same thesis and submit to a further oral, practical or written examination within a period specified by it but not exceeding eighteen months.

(4) The Committee shall, after consideration of the examiners' reports and the reports of any oral or written or practical examination, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering (ME), Master of Science (MSc) and Master of Surveying (MSurv) without supervision

1. The degree of Master of Engineering or Master of Science or Master of Surveying without supervision may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. A candidate for the degree shall have been awarded an appropriate degree of Bachelor from 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 a candidate for the degree without supervision shall be made on 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 synopsis of the work should be available.

Thesis

4. (a) 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 such work is related to the thesis.

(5) Three copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of theses 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 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 (or department) 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 a concise report on 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 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 represent 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 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 (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) demonstrate ability to undertake research by the submission of a thesis embodying the results of an original investigation of an approved topic, or

(c) undertake an approved combination of the above in which case the thesis component shall be referred to as a project report.

(3) The program of advanced study shall total a minimum of 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 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 to 48 Project Report

4. (1) A candidate who undertakes a36 to 48 credit points 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 36 to 48 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.

Master of Environmental Studies (MEnvStudies)

See Master of Applied Science above.

Master of Safety Science (MSafetySc)

1. The degree of Master of Safety 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 (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 lodge with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the degree shall be required to undertake such formal subjects and pass such assessment as prescribed. The program of advanced study shall total a minimum of 45 credits. The number of credits allocate for each subject shall be determined by the Committee on the recommendation of the Course Director (hereinafter referred to as the head of the school).

(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 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 six academic sessions from the date of enrolment for a full-time candidate and ten sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee

48 credit point Project Report

4. (1) The program of advanced study may include a 48 credit point 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 the 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 of 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 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 subject, recommend whether or not the candidate may be awarded the degree. If it is decided that the project report is unsatisfactory the Committee shall determine whether or not the candidate may resubmit it after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Science (MSc)

See Master of Engineering above.

Master of Science (MSc) - without supervision

See Master of Engineering without supervision above.

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 attainments 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 prescribed, 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.

Scholarships and Prizes

The scholarships and prizes listed below are available to students whose courses are listed in this book. Each faculty handbook contains in its Scholarships and Prizes section the scholarships and prizes available with that faculty. The **General Information** section of the Calendar contains a comprehensive list of scholarships and prizes offered throughout the University. Applicants should note that the awards and conditions are subject to review.

Key: **V** Value **T** Year/s of Tenure **C** Conditions

Scholarships

Undergraduate Scholarships

Provided below is an outline of undergraduate scholarships. Students should check the scholarships listed in the General Section and those listed for their Faculty. Students should also consult the Scholarship information for related Faculties. Applicants should note that the awards, conditions and particularly closing dates may vary from year to year.

Unless otherwise indicated application forms and further information are available from the Student Centre (lower Ground Floor, Chancellery) and applications should be submitted by 31 January each year. Applications normally become available four to six weeks before the closing date. Scholarship information is regularly included in the University publication 'Uniken/Focus'.

Students investigating study opportunities overseas should consult Study Abroad which is published by UNESCO and is available in the University library. The UNSW International Student Centre can provide information about exchange programs (see the 'Go Away Travel Scholarship' included in the General section below).

The British Council (tel 02 3262365) may be of assistance for information about study in Britain. The Australian American Education Foundation (tel 06 2479331) can provide information about study in America. Information may also be obtained from the embassy or consulate of the country in which study is proposed and the proposed overseas institution.

Details of overseas awards and exchanges administered by the Department of Employment, Education and Training can be obtained from the Awards and Exchanges Section, Department of Employment, Education and Training, PO Box 826, Woden, ACT 2606.

General

Alumni Association

V Up to $1500 pa

T 1 year with the possibility of renewal

C Available to students enrolled in any year of a full-time course. Candidates must be the children or grandchildren of Alumni of the University of New South Wales and may be either permanent residents of Australia or international students. Applications close 13 January.

Apex Foundation for Research into Intellectual Disability Studentships

V $1000 paid in a lump sum.

C Applicant should be preparing a thesis related to intellectual disability. Applications should be in the form of a letter which includes a curriculum-vitae and thesis plan and must be supported by a letter from the Head of School/Department. Applications should be sent to the Honorary Secretary, Apex Foundation Studentships, PO Box 311, Mt Evelyn VIC 3796 by 31 May.

Australian Development Co-operation Scholarship (ADCOS)

V Tuition fees. Some students may be eligible for airfares and a stipend.

T Determined by normal course duration

C This award is for international students from selected countries only. Information should be obtained from the Australian Education Centre or Diplomatic Post in the home country. Conditions and entitlements vary depending on the home country. The closing date is normally early in the year before the year of study.

Australian Vietnam Veterans Trust Education Assistance Scheme

V $3,500 pa for the duration of the course.

C Applicant must be a child of a Vietnam veteran and under the age of 25 at the time of application. The award is subject to the same income test as AUSTUDY. Applicants can be undertaking any year of a Bachelors course. Applications and further information are available from the Trust's Regional Offices in each state capital. Applications close 31 October.

General Accident Australian Bicentennial St Andrews Scholarship

V £4840 (Stg)

T Approximately 12 months

C Applicants should be Australian citizens who are proceding to Honours in Economics, History, Philosophy, Economic and Social History or Social Anthropology. The awards are for study at St Andrews, United Kingdom. Applications close 12 November.

Girls Realm Guild

V Up to $1500 pa

T 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need

C Available only to female students under 35 years of age who are permanent residents of Australia enrolling in any year of a full-time undergraduate course. Selection is based on academic merit and financial need

Go-Away Travel Scholarships

V Up to $1500 pa

T 1 year

C 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 for credit overseas. Awards will be granted on the basis of academic merit. Interested students should contact the International Student Centre.

Grains Research and Development Corporation (GRDC) Undergraduate Honours Scholarship

V $6000 (ie $5000 to the student and $1000 to the host School/Department).

T 1 year

C Applicants must be undertaking a full-time Honours program. Study in an area of significance to the grains industry will be viewed favourably. Written applications including a curriculum-vitae, academic record, letter of support from the Head of School/Department and 2 referees' supporting statements should be sent to GRDC Undergraduate Honours Scholarship, PO Box E6, Queen Victoria Terrace, Canberra ACT 2600 (tel 06 2725528). Applications close 25 November.

Great Barrier Reef Marine Park Authority Research Support

V $1500

C 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 16 December.

Mitsui Education Foundation Scholarship

C A one month scholarship to Japan is available to a young Australian national to help promote goodwill between the two countries. Candidates should be full-time undergraduate students aged between 20-24 and preferably in their third or fourth year. The successful student will travel to Japan during November and December. Applications become available in July and close mid-August with the Scholarship Unit.

National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships

V $22,250

T Up to 3 years

C Applicants may be undertaking an undergraduate degree in order to pursue research relevant to Aboriginal health. Applications close 24 July with the Scholarship Unit.

Pig Research and Development Corporation (PRDC) Undergraduate Encouragement Award

V $600 lump sum.

C Applicants must be in the later stage of an undergraduate degree and interested in undertaking a research project related to the Australian pig industry. Applications close 3 times a year (ie 1 March, 1 July, 1 October) with the PRDC, PO Box 4804, Kingston ACT 2604.

River Basin Management Society Ernest Jackson Memorial Research Grants

V Up to $2000

C To assist tertiary students undertaking research in the field of River Basin Management. Applications close with the Research Grants Co-ordinator, PO Box 68, Clifton Hill VIC 3068 on 11 August.

RSPCA Alan White Scholarship

V $2500

C Applicants should be undertaking original research to improve the understanding and welfare of animals. Written applications should be sent to the Executive Officer, RSPCA Australia, PO Box E369, Queen Victoria Terrace, Canberra ACT 2600 (tel 06 2311437) by 31 March.

Sam Cracknell Memorial

V Up to $1500 pa

T 1 year

C 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 7 March.

Sporting Scholarships

V $2000 pa

T 1 year with possibility of renewal

C Available to students who are accepted into a course of at least two years duration. Prospective applicants should have an outstanding ability in a particular sport and are expected to be an active member of a UNSW Sports Club. Apply directly to the Manager, Sports Association, UNSW, Sydney 2052 (tel 385 4878).

The STA Travel Grant

V Up to $3000

C 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 30 April each year.

University Honours Year Scholarships

V $1000

T 1 year

C A number of scholarships will be awarded on the basis of academic merit for students entering an 'add-on' honours year, that is 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 with the Scholarship Unit on 30 November.

W.S. and L.B. Robinson

V Up to $6500 pa

T 1 year renewable for the duration of the course subject to satisfactory progress

C Available only to students who completed their schooling in Broken Hill or whose parents reside in Broken Hill and undertaking a course related to the mining industry. Includes courses in mining engineering, geology, electrical and mechanical engineering, metallurgical process engineering, chemical engineering and science. Apply directly to PO Box 460, Broken Hill, NSW 2880. Applications close 30 September each year.

Applied Science

Students planning to undertake Year One of a Bachelors degree in any school of the Faculty of Applied Science can apply for the Malcolm Chaikin Foundation Scholarship

Malcolm Chaikin Foundation Scholarship

V Up to $8000 pa

T 1 year renewable for the duration of the course subject to satisfactory progress

C Applicants must be Permanent Residents. Scholarship is available to students entering the first year of any course in the Faculty of Applied Science leading to the award of the degree of Bachelor of Science or Engineering. Applications close 13 January.

Ceramic Engineering

Australasian Ceramic Society

V Up to $400 pa

T 1 year renewable for the duration of the course subject to satisfactory progress

C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

Monier PGH Limited

V Up to $1000 pa

T 1 year renewable for the duration of the course subject to satisfactory progress

C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

Clay Brick Association

V Up to $2500 pa

T 1 year renewable for the duration of the course subject to satisfactory progress

C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

The Thomson Family

V Up to $1000 pa

T 1 year renewable for the duration of the course subject to satisfactory progress

C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

Zacuba Pty Ltd

V Up to $1000 pa

T 1 year renewable for the duration of the course subject to satisfactory progress

C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

Food Science and Technology

Coca-Cola South Pacific Export Corporation

V Up to $1800 pa

T 1 year renewable for the duration of the course subject to satisfactory progress

C Permanent residence in Australia. Not more than 22 years of age on 1 December preceding the year in which the award commences and eligible for admission to Year 1 of the full-time degree course in Food Science and Technology

George Weston Foods

V Up to $1500 pa

T 1 year renewable for the duration of the course subject to satisfactory progress.

C Permanent residence in Australia. Available to students commencing Year 1 of the full-time degree course in Food Science and Technology. Applications close at the end of January.

Metallurgy

Comalco Research Award

V Up to $2000

C Eligibility for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Process Engineering

Pasminco Scholarship

V Up to $1000 pa

T 1 year

C One scholarship for a student entering Year 4 of the Bachelor of Metallurgical Engineering. Applications close 7 March 1996.

Sir Rupert Myers

V Up to $2500 pa

T 1 year renewable for the duration of the course subject to satsfactory progress

C Open to students who are Permanent Residents or whose parents are permanent residents of Australia and who are eligible for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Engineering

Mines

The Charles Warman Scholarship

V $4000 pa

T 1 year renewable subject to satisfactory progress

C Permanent residence in Australia and enrolling in the full-time degree course in Mineral Engineering (BE or BE/BSc). Applications close 7 March.

Minproc Engineering Limited Scholarship

V $6500 pa

T 1 year renewable for the duration of the course subject to satsfactory progress

C Available to a student entering either Year 3 or 4 of the Bachelor of Engineering Science course with subject content in the fields of Engineering or Mineral Chemistry, or a Bachelor of Engineering with majors in the fields of Chemical, Metallurgical or Mechanical Engineering, or related courses. Applications close 7 March.

RGC Scholarship in Economic Geology

V $5000

T 1 year

C Awarded to a student entering Stage 4 of the Applied Geology course or an Honours year in Geology in the Science course, undertaking a field project relevant to economic geology.

Aus IMM Endowment Fund Scholarship

V $4000 pa in Years 1 and 2, $7000 pa in Years 3 and 4

T 1 year for Year 1; 1 year renewable for the duration of the course subject to satisfactory progress for Years 2-4

C Permanent residence in Australia, eligibility for admission to either the Applied Geology or Mining Engineering undergraduate degree program, and intention to pursue career in the mineral industry. Applications in writing to the Head of School of Mines

Petroleum Engineering

Society of Petroleum Engineers Pty Ltd

V Up to $2500

C Applicants must be permanent residents and have completed the first two years of any accredited Engineering program.

Wool and Animal Science

School of Wool and Animal Science EL O'Brien Scholarship

V Up to $2000 pa

T 1 year

C The NSW Farmers Association is offering a scholarship for a student entering Year 4. Applicants must be a member, or child of a member of the Association. Applications close 7 March 1996.

The UNSW Co-op Program

The University of New South Wales has industry-linked education scholarships to the value of $9800 per annum in the following areas: Accounting (and Economics or Finance); Business Information Technology; Aerospace, Bioprocess, Ceramic, Chemical, Civil, Electrical, Environmental, Materials, Mechanical, Mechatronics, Metallurgical, Mineral, Mining and Petroleum Engineering; Food Science and Technology, Industrial Chemistry, ManufacturingManagement, Textile Management, Textile Technology, and Wool and Pastoral Science.

Graduate Scholarships

Provided below is an outline of Graduate Scholarships. Students should check the scholarships listed in the General Section and those listed for their Faculty. Students should also consult the Scholarship information for related Faculties. Applicants should note that the awards, conditions and particularly closing dates may vary from year to year.

Unless otherwise indicated application forms and further information are available from the Student Centre (lower Ground Floor, Chancellery). Applications normally become available four to six weeks before the closing date.

Scholarship information is regularly included in the University publication 'Uniken/Focus'.

Students investigating study opportunities overseas should consult Study Abroad which is published by UNESCO and is available in the University library. The British Council (tel 02 3262365) may be of assistance for information about study in Britain. The Australian American Education Foundation (tel 06 2479331) can provide information about study in America. Information may also be obtained from the embassy or consulate of the country in which study is proposed and the proposed overseas institution.

Details of overseas awards and exchanges administered by the Department of Employment, Education and Training can be obtained from the Awards and Exchanges Section, Department of Employment, Education and Training, PO Box 826, Woden, ACT 2606.

General

The main programs of assistance for postgraduate study are:

Australian Postgraduate Awards (APA)

V $14,961 (1995 rate). Other allowances may also be paid.

T Up to 2 years for a Masters, 3 years for a PhD degree. PhD students may request in certain circumstances up to 6 months extension.

C Applicants must be honours graduates or equivalent or scholars who will graduate in current academic year and proposing to undertake a Masters by Research or PhD. Applicants must be Permanent Residents who have lived continuously in Australia for 12 months or Australian citizens. Applications to Scholarship Unit by 31 October.

Australian Development Co-operation Scholarship (ADCOS)

V Tuition fees. Some students may be eligible for air fares and a stipend.

T Determined by normal course duration

C This award is for international students from selected countries only. Information should be obtained from Australian Diplomatic Posts or Australian Education

Centres in the home country. Conditions and entitlements vary depending on the home country.

Overseas Postgraduate Research Scholarships (OPRS)

V Tuition fees and medical cover only.

T 2 years for a Masters and 3 years for a PhD degree

C Eligibility is confined to postgraduate research students who are citizens of countries other than Australia or New Zealand. Applications to the Scholarship Unit by 30 September

Other General Scholarships:

Australian Bicentennial Scholarships and Fellowships Scheme

V £4000 (Stg)

T At least 3 months

C Applicant must be enrolled as a postgraduate student at an Australian higher education institution and usually resident in Australia. Awards are available for study in the UK in any discipline. Applications close with the Executive Director, Australian Vice-Chancellors' Committee, GPO Box 1142, Canberra ACT 2601 on 31 October.

Australian Brewers Foundation Alcohol Related Medical Research Postgraduate Scholarships

V Similar to the NH&MRC (see NH&MRC entry under General).

T 2 years

C Similar to the NH&MRC. Applications and further information may be obtained from the Secretary, ABF - Medical Research Advisory Committee, Level 8, 235 Pyrmont Street, Pyrmont 2008 (tel 552668).

Australian Geographical Survey Organisation (AGSO) Postgraduate Awards in Geosciences

V $20,323 plus allowances

T Up to 3 years

C Applicants must be enrolled or enrolling in a full-time PhD. Applicants must be permanent residents with 12 months continuous residency in Australia or Australian citizens. Applications which include a curriculum-vitae should be sent to the Postgraduate Scholarship Co-ordinator, Human Resources Services, AGSO, GPO Box 378, Canberra ACT 2601 (tel 06 2499673). Applications close 11 August.

Cambridge Australia Scholarships including the Packer Scholarships

V Fees and maintenance allowance of £5340 (stg), return air travel to the UK.

T Up to 3 years

C Applicants must be Australian citizens who graduated with honours 1 or equivalent, from an Australian University who have gained admission to a PhD at Cambridge. Applicants must also have won a British Overseas Research Student Award. Applicants should request an application for the scholarship at the time of applying for admission to Cambridge. Enquiries can be directed to the Cambridge Commonwealth Trust, Canberra (tel 06 249 7204). Applications close 30 April.

Commonwealth Scholarship and Fellowship Plan (CSFP)

V Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.

T Usually 2 years, sometimes 3

C Applicants must be graduates who are Australian citizens. Tenable in Commonwealth countries other than Australia. Applications close at different times depending on the country in which the study is proposed.

Federation of University Women

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 Australian Federation of University Women. The NSW Branch Office is located in the Dymocks Building, 428 George Street, Sydney NSW 2000 (tel 232 5629).

Frank Knox Memorial Fellowships

V $US13,500 pa plus tuition fees and student health insurance

T 1 year with the possibility of renewal for a further year.

C Applicants must be Australian citizens, who are graduates or near graduates of an Australian university. Applications close with the Scholarship Unit mid-October.

Fulbright Postgraduate Student Awards

V Up to $A29,250 depending on the type of award.

T 1 year

C Applicants must be enrolled in a higher degree at an Australian institution and wishing to undertake research at an American institution. The research should be related to School-to-Work transition, Visual Arts, Performing Arts, Journalism, Engineering or Business Administration. Awards are also available for Aboriginal and Torres Strait Islander students. Applications and additional information are available from the Honorary Secretary, Fulbright NSW State Selection Committee, Research and Scholarships Office, Sydney University 2006 (tel 02 3514464).

Gowrie Scholarship Trust Fund

V $6000 pa. Under special circumstances this may be increased.

T 2 years. Under special circumstances this may be extended.

C Applicants must be members of the Forces or children (or grandchildren or lineal descendants) of members of the Forces who were on active service during the 1939-45 War. Applications close with the Scholarship Unit by 31 October.

Grains Reseach and Development Corporation (GRDC) Junior Research Fellowship

V $21,000 plus up to $3,000 to the supporting institution, some conference/workshop attendance allowances.

T Up to 3 years

C Applicants must be undertaking full-time research toward a PhD. Applicants must be Australian citizens or entitled to reside permanently in Australia. Applications should be sent to the Junior Research Fellowship, GRDC, PO Box E6, Queen Victoria Terrace, Canberra ACT 2600 (tel 06 2725525) on 25 November.

Great Barrier Reef Marine Park Authority Research Support

V $1000

C Applicants must be enrolled in a full-time PhD or Honours year with a 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 07 7818811). Applications close 16 December.

The Harkness Fellowships

V Travel and other allowances for travel and study in the USA

T 12-21 months

C Candidates must be Australian citizens or have taken steps to achieve citizenship. The candidate will usually have an honours degree or equivalent, or an outstanding record of achievement in creative arts, journalism or other career. The award focuses on health care, education, employment and training schemes and issues which affect the quality of life in cities. Applicants should be over 21 years of age. Applications and further information are available from Mr R Beale, Department of the Prime Minister and Cabinet, 3-5 National Circuit, Barton ACT 2600. Applications close 30 September.

Kobe Steel Scholarship for Postgraduate Study at St Catherine's College, Oxford University

V Maintenance allowance of at least £7,000 (stg) plus tuition fees and dues and travelling expenses to and from Oxford.

T Up to 2 years with the possibility of some extension.

C Applicants must be Australian nationals. Students should have a past or future interest in Japan. Applications close on 31 October with the Australian Vice-Chancellor's Committee (AV-CC), GPO Box 1142, Canberra ACT 2601.

Land and Water Resources Research and Development Corporation (LWRRDC)

V $20,000 pa plus $5,000 for operating expenses

T 2 years for a Masters, 3 years for a PhD degree

C The scholarships are available for research that will lead to better management, sustainable use and conservation of land, water and vegetation resources in Australia. Applications close with the LWRRDC on 28 July. Applications should be forwarded to the LWRRDC, GPO Box 2182, Canberra, ACT (tel 06 2573379).

Menzies Research Scholarship in the Allied Health Sciences

V Up to $24,000 pa

T 2 years

C The scholarship is awarded to stimulate research by persons working in the health field in disciplines other than medicine. Applications close on 25 September with the Menzies Foundation, 210 Clarendon St, East Melbourne Vic 3002.

National Drug Strategy (NDS) Postgraduate Research Scholarship

V $21,666 pa

T Initially for 1 year, with the possibility of renewal for a further 2 years

Applicants must have completed Year 1 of a PhD program. Scholarships aim to develop expertise in researching and evaluating non-biomedical approaches to the prevention and treatment of drug misuses. Selection is based on academic merit, work experience and the potential of the project. Applications close 15 July.

National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships

V $22,250

T Up to 3 years

C Applicants must enrol for a diploma, certificate, undergraduate degree or postgraduate research degree in order to pursue research relevant to Aboriginal health. Applications close 24 July with the Scholarship Unit.

National Health and Medical Research Council (NH&MRC) Dora Lush Postgraduate Scholarships

V $14,961 (or $19,307 for AIDS research) plus allowances

T Up to 3 years

C Applicants should be permanent residents living in Australia or Australian citizens who have already completed a Science honours degree or the equivalent at the time of submission of the application. Students enrolled in the honours year at the time of application are **not** eligible. Applications close 24 July with the Scholarship Unit.

National Health and Medical Research Council (NH&MRC) Medical Postgraduate Scholarships

V $22,250 plus allowances

T Up to 3 years

C Applicants must be Australian citizens or permanent residents who are medical graduates. Applications are particularly encouraged from students in the following fields - alcohol and substance abuse, prostate cancer, nursing and allied health services, breast cancer, dementia, injury and HIV/AIDS. Applications close 23 June with the Scholarship Unit.

National Health and Medical Research Council (NH&MRC) Public Health Postgraduate Scholarships

V $19,500 (science graduates), $22,000 (medical graduates) plus allowances

T Up to 3 years

C The scholarship is designed to enable graduates to obtain formal academic training in public health research. Applications close 23 June with NH&MRC.

Pig Research and Development Corporation (PRDC) Postgraduate Top-Up Scholarships

V A supplement to other scholarship(s) up to a maximum of $21,000 plus possibility of other allowances.

C Applicants must be Australian citizens or permanent residents who are eligible for another scholarship. Applicants must be undertaking a research project that will provide training relevant to establishing a career in the Australian pig industry. Applications close with the PRDC, PO Box 4804, Kingston ACT 2604 on 1 December.

Pig Research and Development Corporation Research Fellowship

V $25,000 plus allowances

T Up to 3 years

C Applicants must be undertaking a PhD with research relevant to the increased competitiveness of the Australian pig industry. Applications close with the PRDC, PO Box 4804, Kingston ACT 2604 on 1 December.

The Rhodes Scholarship to Oxford University

V Approximately $15,000 pa, fees and assistance with travel

T 2 years, may be extended for a third year

C Australian citizens aged between 19 and 25 who have an honours degree or equivalent. Applications close September each year with The Honorary Secretary to the NSW Rhodes Selection Committee, Building G17, University of Sydney, NSW 2006 (tel 3514567).

River Basin Management Society Ernest Jackson Memorial Research Grants

V Up to $2000

C To assist tertiary students undertaking research in the field of River Basin Management. Applications close with the Research Grants Co-ordinator, PO Box 68, Clifton Hill VIC 3068 on 11 August.

Robert Gordon Menzies Scholarship to Harvard

V Up to $A25,000. Students who enrol in the Harvard Business School may be provided an additional $12,000.

T To be determined

C Tenable at Harvard University. Applicants must be Australian citizens or permanent residents and graduates of an Australian tertiary institution. The successful applicant will be expected to repay the scholarship in later years when circumstances permit. Applications and additional information may be obtained by writing to the Management Services Office, ANU, Canberra ACT 0200. Applications close 5 January.

RSPCA Alan White Scholarship

V $2500

C Applicants should be undertaking original research to improve the understanding and welfare of animals. Written applications should be sent to the Executive Officer, RSPCA Australia, PO Box E369, Queen Victoria Terrace, Canberra ACT 2600 (tel 06 2311437) by 31 March.

Shell Scholarship in Science or Engineering

V $20,000 pa

T Up to 3 years

C Applicants must be Australian citizens or permanent residents. Applicants should intend to study a Doctorate in science, engineering, economics/commerce, computer science, or a closely related discipline. Applications close with Shell Australia, Box 872k GPO, Melbourne VIC 3001 (tel 03 96665666) on 27 October.

STA Travel Grant

V Up to $3000

C 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 30 April each year.

The Wenkart Foundation Grants

V Up to $22,000 pa

T 2 years but may be renewed

C Applicants must be permanent residents or undergraduates educated in Australia and planning to reside in Australia. Applicants must be undertaking full-time research in clinical, biomedical and health related sciences. Applications close with the Scholarship Unit on 24 May.

Applied Science

Australian Wool Research and Promotion Organisation (AWRAP) Postgraduate Scholarships

V $21,362 pa plus allowances

T Up to 3 years

C Tenable in Australian tertiary institutions or overseas in exceptional circumstances. Applications close with the AWRAP, GPO Box 4867, Melbourne VIC 3001 on 31 October.

Dairy Research and Development Corporation (DRDC) Postgraduate Education Scholarships

V Depends on the applicant's level of academic achievement

C The DRDC will treat the following as priority fields of research - pasture ecology and agronomy, milk havesting, dairy reproduction and nutrition, cheesemaking, dairy farm economics and industry supply/demand analysis. Applications close with the Scholarship Unit on 24 October. Contact the DRDC (tel 03 98890577) for more information.

Energy Research and Development Corporation (ERDC) Postgraduate Awards

V $21,000 pa plus $3000 operating expenses to the institution.

T Up to 3 years

C Applicants must be permanent residents or citizens. ERDC awards are based on academic excellence or a proven track record of excellence in research which indicates potential to contribute to the energy industry. Contact ERDC Postgraduate Awards, ERDC, GPO Box 629, Canberra ACT 2601 (tel 06 2744804) for an application. Applications close 20 October.

Meat Research Corporation (MRC) Postgraduate Study Award

V $14,961 for study in a Masters or Diploma, $20,500 for a PhD in Australia or $US17,500 for study overseas. Allowances may be payable.

T Up to 3 years

C Applicants must be Permanent Residents or citizens of Australia. Applicants should be proposing to undertake research in areas of practical value to the Australian beef, sheepmeat, goatmeat and buffalo industries. Applications close 31 August with the MRC, PO Box A498, Sydney South 2000.

Rural Industries Research and Development Corporation (RIRDC) Postgraduate Scholarships

V $21,500 pa plus $3,500 to the host institution

T Up to 3 years

C Applicants must be Australian citizens or Permanent Residents. Applications close 16 November with the RIRDC, PO Box 4776, Kingston ACT 2604.

Sugar Research and Development Corporation (SRDC) Postgraduate Scholarships

V $22,000 pa plus $3,000 to the host institution

T Up to 3 years

C Applicants must be permanent residents or citizens. Applications close 30 September with the Executive Director, PO Box 12050, Elizabeth St, Brisbane, Q4002.

Prizes

Undergraduate University Prizes

The following information summarises undergraduate prizes awarded by the University. Prizes which are not specific to any School are listed under General. All other prizes are listed under the faculty, school or department in which they are awarded. Law prizes are awarded only for students enrolled in the LLB or Jurisprudence courses.

Information regarding the establishment of new prizes may be obtained from the Enrolments and Assessment Section located on the Ground Floor of the Chancellery.

General

The Sydney Technical College Union Award

V $400.00 and Bronze Medal

C Leadership in student affairs combined with marked academic proficiency by a graduand

The University of New South Wales Alumni Association Prize

V Statuette

C Achievement for community benefit by a student in the final or graduating year

School of Applied Bioscience

Department of Biotechnology

The Amersham Modern Techniques in Biotechnology Prize

V $250.00

C The best performance in BIOT3061 Modern Techniques in Biotechnology

The Burns Philp Foods Prize

V $3000.00

C The best performance in BIOT3100 Fermentation Processes in the Bachelor of Science degree course

The Burns Philp Foods Prize

V $300.00

C The best performance in one of the Level 3 Biotechnology subjects BIOT3011 Biotechnology A BIOT3021 Biotechnology B BIOT3031 Microbial Genetics BIOT3061 Modern Techniques in Biotechnology by a student in the Bachelor of Science degree course

The Burns Philp Foods Prize

V $300.00

C The best overall performance in the Bachelor of Science degree course in Biotechnology at honours level

Department of Food Science and Technology

The Flavourfresh Food Prize

V $400.00

C The best performance in FOOD1310 Food Preservation by a full-time student in the Bachelor of Science degree course in Food Science and Technology

The Nestle Australia Limited Prize

V $200.00

C The best performance in FOOD1400 Project in the Bachelor of Science degree course in Food Science and Technology

The Wilfred B S Bishop Prize

V $75.00

C The best overall performance in the Bachelor of Science degree course in Food Science and Technology by a student who has made a significant contribution to staff and student activities

School of Chemical Engineering and Industrial Chemistry

The Abbott Laboratories Pty Ltd Prize

V $200.00

C The best performance in Year 4 of the Bachelor of Engineering degree course in Chemical Engineering

The Akzo Chemicals Prize

V $500.00

C The best performance in INDC3090 Chemistry of Industrial Processes

The Australasian Corrosion Association (NSW Branch) Award

V $150.00 and one year membership of the Association

C The best performance in INDC3041 Corrosion in the Chemical Industry

The Australian Institute of Energy Prize

V $50.00

C The best performance in a subject selected by the Head of School

The Australian Paper Manufacturers Ltd Prize

V $200.00

C The best performance in INDC3070 Instrumentation and Process Control 1 in the Industrial Chemistry degree course.

The Australian Paper Manufacturers Ltd Prize

V $200.00

C The best performance in CHEN3070 Process Control in the Chemical Engineering degree course

The BHP Engineering Prize

V $150.00

C The best performance in Year 3 of the Chemical Engineering course

The BOC Gases Prize

V $200.00

C Meritorious performance in CHEN4080 Design Project

The Bristol Myers Prize

V $150.00

C Meritorious performance in CHEN4030 Safety and Environmental

The Cargill Australia Prize

V $500.00

C The best performance in CHEN4120 Process Plant Management and Operation

The Carlton & United Breweries Prize

V $300.00

C Meritorious performance in CHEN4120 Process Plant Management and Operation

The Comalco Aluminium (Bell Bay) Prize

V $250.00

C The best performance in the Chemical Engineering course

The Comalco Aluminium (Bell Bay) Prize

V $250.00

C Meritorious performance in CHEN4090 Research Project

The Comalco Aluminium (Bell Bay) Prize

V $250.00

C The best performance in CHEN4030 Safety and Environment

The Dorr-Oliver Prize

V $200.00

C The best performance in CHEN3040 Separation Processes 1

The Dow Corning Prize

V $300.00

C The best performance in CHEN4080 Design Project

The Dow Corning Prize

V $300.00

C The best performance in CHEN4090 Research Project

The Dow Corning/SCM Chemicals Prize

V $500.00

C The best performance in CHEN4101 Environmental Management

The Dupont/Waste Service of NSW Prize

V $300.00

C Meritorious performance in CHEN4101 Environmental Management

The Fuel Technology Staff Prize

V $200.00

C The best performance in FUEL4090 Fuel and Energy Research Project

The Goodman Fielder Prize

V $250.00

C The best performance in CHEN3090 Chemical Engineering Applications

The Hoescht Australia Prize

V $200.00

C Meritorious performance in CHEN4120 Process Plant Management and Operation

The Johnson Matthey Prize

V $200.00

C The best performance in the Industrial Chemistry degree course

The National Starch & Chemical Prize

V $500.00

C The best performance in POLY3010 Polymer Science

The RGC Prize

V $200.00

C The best performance in CEIC2010 Instrumental Analysis

The RGC Prize

V $200.00

C The best performance in MINP4010 Hydrometallurgical Processes

The Shell Prize

V $200.00

C The best performance in a subject selected by the Head of School

The Shell Prize

V $100.00

C The best performance by a student in Year 2 or equivalent part-time stage of the Chemical Engineering or Industrial Chemistry degree course, including sporting and student activities

The Shell Prize

V $200.00

C The best performance by a student in Year 3 or equivalent part-time stage of the Chemical Engineering or Industrial Chemistry degree course, including sporting and student activities

The Shell Prize

V $200.00

C The best performance by a student in Year 4 or equivalent part-time stage of the Chemical Engineering or Industrial Chemistry degree course, including sporting and student activities

The Shell Prize

V $100.00

C 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 Simon Carves Australia Prize

V $200.00

C The best performance in CHEN4080 Design Project

The Wattyl Australia/James Hardie Prize

V $400.00

C Meritorious performance in CHEN4101 Environmental Management

The Western Mining Corporation Ltd Prize

V $150.00

C The best performance in CHEN2050 Chemical Engineering Laboratory 1

The Western Mining Corporation Ltd Prize

V $150.00

C The best performance in CHEN3080 Chemical Engineering Laboratory 2

School of Fibre Science and Technology

Department of Textile Technology

The J B Speakman Prize

V $50.00

C The best undergraduate thesis in the final year of the Bachelor of Science degree course in Textile Technology or Textile Management

The R J Webster Prize

V $250.00

C The best performance throughout the Bachelor of Science degree course in Textile Technology or Textile Management

The Textile Institute Prize

V Two years free membership of the Textile Institute

C The best performance in Textile Technology by a student in the Bachelor of Science degree course in Textile Technology or Textile Management

Department of Wool and Animal Science

The Bayer Animal Health Prize

V $120.00

C The best performance in Years 2 and 3 of the Bachelor of Science degree course in Wool and Pastoral Sciences

The C R Lucock Prize

V Voucher drawn on Uni.Co-op Book shop valued at $60.00

C The best performance in Meat Science in the Department of Wool and Animal Sciences

The National Farmers' Federation Prize

V $150.00

C Excellent academic attainment by a graduating student in the Bachelor of Science degree course in Wool and Pastoral Sciences

The P R McMahon Memorial Prize

V $100.00

C The best performance in the year 4 project in Applied Geography by a student in the Bachelor of Science degree course

The Parkes Wool Promotion Committee Prize

V A shield held in the Department of Wool and Animal Science on which the name of the successful student is engraved each year

C The best performance in Practical Wool Studies in the Department of Wool and Animal Sciences

School of Geography

The Jack Mabbutt Medal

V Medal

C The best performance in the Year 4 Project in Applied Geography by a student in the Bachelor of Science degree course

The Jack Mabbutt Prize

V $150.00

C Best performance by a third year student proceeding to Geography at honours level

School of Materials Science and Engineering

The ACI Glass Packaging Prize

V $200.00

C Outstanding quality in an honours thesis in one of the areas of glass or glass-ceramics in the Bachelor of Engineering degree course in Ceramic Engineering

The ANSTO Prize

V $100.00

C The best performance in year four in the Bachelor of Engineering degree course in Ceramic Engineering

The Austral Bricks Prize

V $100.00

C The best performance in year three in the Bachelor of Engineering degree course in Ceramic Engineering

The Australasian Ceramic Society Prize

V $100.00

C The highest overall course aggregate by a student completing the final year of the Bachelor of Engineering degree course in Ceramic Engineering

The Australasian Corrosion Association (NSW) Prize

V $150.00

C The best performance in MATS1203 Materials and Design 2 by a student in the Bachelor of Metallurgical Engineering degree course

The Boral Bricks Prize

V $500.00

C The best performance in MATS2273 Chemistry of Ceramic Processing, Unit 2, Technical and Non-Technical Ceramics in the Bachelor of Engineering degree course in Ceramic Engineering

The Broken Hill Proprietory Company Prize

V $1,000.00

C The best performance in the Metallurgical Engineering degree course by a graduating student

The Capral Aluminium Ltd Prize

V $200.00

C The best performance in a subject selected by the Head of School

The Caroma Industries Limited Prize

V $400.00

C The best performance in MATS1464 Materials Seminar and MATS2304 Project (Ceramic Engineering) (with each subject receiving one half of the weighting for the average) in the Bachelor of Engineering degree course in Ceramic Engineering

The Commercial Minerals Limited Prize

V $200.00

C The best performance in MATS2133 Ceramic Raw Materials in the Bachelor of Engineering degree course in Ceramic Engineering

The Ferro Corporation (Australia) Prize

V $250.00

C The best performance in MATS2123 Ceramic Process Principles 2 in the Bachelor of Engineering degree course in Ceramic Engineering

The Hugh Muir Prize

V $275.00

C 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 ICI Advanced Ceramics Prize

V $100.00

C The best overall academic performance by a student in the second year of the Bachelor of Engineering degree course in Ceramic Engineering

The Institute of Metals and Materials Australasia Prize

V $200.00and one years membership of the Institute

C The best performance in a subject selected by the Head of School

The Laporte Minerals Prize

V $250.00

C 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) by a student in the Bachelor of Engineering degree course in Ceramic Engineering

The Max Hatherly Prize

V $275.00

C The best performance in MATS1002 Microstructural Analysis

The Monier PGH Prize

V $1,000.00

C The best performance by a graduating student in the Bachelor of Engineering degree course in Ceramic Engineering

The Morganite Insulating Products Pty Ltd Prize

V $200.00

C The best performance in MATS2254 Ceramic Engineering Design by a student in the Bachelor of Engineering degree course in Ceramic Engineering

The Sialon Ceramics Prize

V $100.00

C The best performance in an honours thesis that reflects an advancement in the technology and development of advanced ceramics by a student proceeding to the award of the degree of Bachelor of Engineering in Ceramic Engineering

The Taylor Ceramic Engineering Prize

V $150.00and Plaque

C The greatest overall amount of ingenuity shown in professional activities by a graduating student in the Bachelor of Engineering degree course in Ceramic Engineering

The Wallarah Minerals Prize

V $100.00

C The best performence in an honours thesis by a student in the Bachelor of Engineering degree course in Ceramic Engineering

The Welding Technology Institute of Australia Prize

V Books from WTIA valued at $200.00and 1 years membership of WTIA

C The best performance in MATS3484/MATS1164 Welding Science and Technology

The Western Mining Corporation Ltd Prize

V $150.00

C The best overall performance in Year 4 full-time (or its part-time equivalent) by a student in the Bachelor of Metallurgical Engineering degree course in Process Metallurgy or the Bachelor of Science (Technology) degree course in Metallurgy

The Western Mining Corporation Ltd Prize

V $150.00

C The best overall performance in Year 3 full-time (or its part-time equivalent) by a student in the Engineering or Bachelor of Science (Technology) degree courses in Materials Science and Engineering

School of Mines

The Stan Sawyer Memorial Prize

V $400.00

C The best performance in an honours thesis on a topic relating to coal mining by a student in the Bachelor of Engineering degree course in Mining Engineering

The Western Mining Corporation Ltd Melbourne Prize

V $200.00

C The best overall performance by a student in the Bachelor of Engineering degree course in Mining Engineering

The Western Mining Corporation Ltd Perth Prize

V $150.00

C The best overall performance by a student in the final year of the Bachelor of Engineering degree course in Mining Engineering

The Western Mining Corporation Ltd Perth Prize

V $150.00

C The best overall performance by a student in third year of the Bachelor of Engineering degree course in Mining Engineering

Department of Applied Geology

The CRAE Mapping Prize in Applied Geology

V $250.00

C The best performance in GEOL3121 Earth Environments 2 - Geological Field Mapping Tutorial by a student in the Bachelor of Science degree course

The CRAE Ore Deposits Prize

V $200.00

C The best overall performance in the 3rd year Economic Geology subject, or in any subject or subjects which may be substituted therefor, by a student proceeding to the award of the degree of Bachelor of Science

The F C Loughnan Prize in Applied Geology

V $340.00

C The best performance in Stage 3 of the Geology component of the Bachelor of Science degree course

The F C Loughnan Prize for Stage 1 Geology

V $100.00

C The best performance in Stage 1 of the Geology component of the Bachelor of Science degree course

The Lorant Eotvos Prize

V $300.00and Bronze Medal

C The best performance in GEOL4111 Advanced Geological Techniques by a student in the final year of the Bachelor of Science degree course in Applied Geology or the Bachelor of Science degree course in Applied Geology at honours level

The Prospectors Supplies Prize

V Brunton Compass

C Meritorious performance in the field work associated with Stage 2 of Course 3000 - Applied Geology or Course 2500 - Geology

Undergraduate and Graduate University Prizes

Department of Applied Geology

The Laric V Hawkins Prize

V $500.00

C The best field project report involving a substantial component of geophysics in a postgraduate program, Year 4 of the Applied Geology course, or an equivalent Honours program in the Science or Advanced Science course

Department of Biotechnology

The AMGEN Australia Award

V $500.00

C The best overall performance in the Master of Applied Science (Biopharmaceuticals) Degree

School of Chemical Engineering and Industrial Chemistry

The Clean Air Society of Australia and New Zealand Prize in Atmospheric Pollution Control

V $100.00

C The highest aggregate in FUEL9810 Atmospheric Pollution Control and FUEL5920 Practical Aspects of Pollution Measurement and Control in a post graduate course in the School of Chemical Engineering and Industrial Chemistry

Department of Food Science and Technology

The Spruson & Ferguson Patent & Trade Mark Prize

V $250.00

C The best performance in the Seminar presentation by a student proceeding to the degree of Master of Science or Doctor of Philosophy in the Department of Food Science and Technology

School of Mines

The Laric V Hawkins Prize

V $500.00

C The best field project report involving a substantial component of geophysics in a postgraduate program, Year 4 of the Applied Geology course, or an equivalent Honours program in the Science or Advanced Science course

Department of Safety Science

MMI Insurance Prize for Introduction to Occupational Disease

V $180.00

C The best performance in CMED9701 Occupational Disease by a student proceeding to the award of the degree of Master of Safety Science or to the Graduate Diploma in Safety Science or the Graduate Diploma in Ergonomics

MMI Insurance Prize for Occupational Medicine

V $150.00

C The best performance in SAFE9262 Occupational Medicine by a student proceeding to the award of the degree of Master of Safety Science, Graduate Diploma in Safety Science or Graduate Diploma in Ergonomics

MMI Prize for Introduction to Occupational Health

V $150.00

C The best performance in SAFE9260 Introduction to Occupational Health by a student enrolled in a diploma or coursework Masters degree offered by the Department of Safety Science

MMI Insurance Prize for Principles of Ergonomics

V $250.00

C The best performance in SAFE9224 Principles of Ergonomics by a student enrolled in a Graduate Diploma or coursework Masters degree course offered by the Department of Safety Science

The Ergonomics Society of Australia (NSW) Prize

V $100.00 and membership of the Society

C The best overall performance in all prescribed core subjects for students eligible to graduate with the Master of Applied Science (Ergonomics) or the Graduate Diploma in Ergonomics

The National Safety Council Prize

V $100.00

C The best performance in SAFE9211 Introduction to Safety Engineering in the Masters Degree or Graduate Diploma in Safety Science

The National Starch & Chemical Prize

V $200.00

C The best performance in SAFE9543 Management of Dangerous Materials by a student enrolled in a Diploma or Coursework Masters degree in the Department of Safety Science.

The Safety Institute of Australia (NSW Division) Bill Lessels' Memorial Prize for Graduate Diploma in Safety Science

V Books to the value of $200.00

C The best overall performance by a student in the Graduate Diploma of Safety Science course

The Safety Institute of Australia (NSW Division) Bill Lessels' Memorial Prize for Master of Safety Science

V Books to the value of $200.00

C The best overall performance by a student in the Master of Safety Science course

The Whiteley Chemicals Prize

V $200.00

C The best performance in SAFE9263 Chemical Safety and Toxicology by a student proceeding to a Diploma or Master's degree in any postgraduate teaching program offered by the Department of Safety Science

Department of Textile Technology

The Malcolm Chaikin Prize

V $200.00 and a bronze medal

C An outstanding PhD thesis in the Department of Textile Technology

Notes

Notes

The University of New South Wales • Kensington Campus

Theatres

Biomedical Theatres E27
Central Lecture Block E19
Chemistry Theatres
(Dwyer, Mellor, Murphy, Nyholm, Smith) E12
Classroom Block *(Western Grounds)* H3
Fig Tree Theatre B14
Io Myers Studio D9
Keith Burrows Theatre J14
MacAuley Theatre E15
Mathews Theatres D23
Parade Theatre E3
Physics Theatre K14
Quadrangle Theatre E15
Rex Vowels Theatre F17
Science Theatre F13
Sir John Clancy Auditorium C24
Webster Theatre G15

Buildings

Applied Science F10
Arcade D24
Architecture H14
Barker Street Gatehouse N11
Basser College *(Kensington)* C18
Central Store B13
Chancellery C22
Dalton *(Chemistry)* F12
Goldstein College *(Kensington)* D16
Golf House A27
Gymnasium B5
Heffron, Robert *(Chemistry)* E12
International House C6
John Goodsell *(Commerce and Economics)* F20
Kensington Colleges *(Office)* C17
Library *(University)* E21
Link B6
Main, Old K15
Maintenance Workshop B13
Mathews F23
Menzies Library E21
Morven Brown *(Arts)* C20
New College L6
Newton J12
NIDA D2
Parking Station H25
Parking Station N18
Pavilions E24
Philip Baxter College *(Kensington)* D14
Quadrangle E15
Sam Cracknell Pavilion H8
Samuels Building F25
Shalom College N9
Webster, Sir Robert G14
Unisearch House L5
University Regiment J2
University Union *(Roundhouse)* E6
University Union *(Blockhouse)* G6
University Union *(Squarehouse)* E4
Wallace Wurth School of Medicine C27
Warrane College M7

General

Aboriginal Resource & Research Centre E20
Aboriginal Student Centre A29
Accommodation *(Housing Office)* E15
Accounting E15
Admissions C22
Adviser for Prospective Students C22
Alumni Relations: *Pindari*, 76 Wentworth St, Randwick
Anatomy C27
Applied Bioscience D26
Applied Economic Research Centre F20
Applied Geology F10
Applied Science *(Faculty Office)* F10
Archives, University E21
Arts and Social Sciences *(Faculty Office)* C20
Asia-Australia Institute: 45 Beach Street Coogee
Audio Visual Unit F20
Australian Graduate School of Management G27
Banking and Finance E15
Biochemistry and Molecular Genetics D26
Biological and Behavioural Sciences *(Faculty Office)* D26
Biomedical Engineering F25
Biomedical Library F23
Biotechnology F25
Built Environment *(Faculty Office)* H14
Campus Services C22
Cashier's Office C22
Centre for Membrane Science & Technology F10, K14
Chaplains E4
Chemical Engineering and Industrial Chemistry F10
Chemistry E12
Civil Engineering H20
Co-op Bookshop E15
Commerce and Economics *(Faculty Office)* F20
Communications Law Centre C15
Community Medicine D26
Computer Science and Engineering G17
Cornea and Contact Lens Research Unit
22-32 King St, Randwick
Economics F20
Education Studies G2
Educational Testing Centre E4
Electrical Engineering G17
Energy Research, Development & Information Centre F10
Engineering *(Faculty Office)* K17
English C20
Equal Employment Opportunity: 30 Botany Street
Randwick
Examinations C22
Facilities Department C22, B14A
Fees Office C22
Fibre Science and Technology G14
Food Science and Technology B8
French C20
Geography K17
Geomatic Engineering K17
German and Russian Studies C20
Graduate School of the Built Environment H14
Groundwater Management and Hydrogeology F10
Health Service, University E15
Health Services Management C22
History C20
Human Resources C22
Industrial Design G14
Industrial Relations and Organizational Behaviour F20
Information, Library & Archives Studies F23
Information Systems E15
Information Technology Unit F25
International Student Centre F9
IPACE Institute F23
Japanese Economic and Management Studies E15
Landscape Architecture K15
Law *(Faculty Office)* F21
Law Library F21
Legal Studies & Taxation F20
Liberal and General Studies C20
Library Lawn D21
Lost Property C22
Marine Science D26
Marketing F20
Materials Science and Engineering E8
Mathematics F23
Mechanical and Manufacturing Engineering J17
Media Liaison C22
Medical Education C27
Medicine *(Faculty Office)* B27
Microbiology and Immunology D26
Michael Birt Gardens C24
Mines K15
Music and Music Education B11
News Service C22
Optometry J12
Pathology C27
Performing Arts B10
Petroleum Engineering D12
Philosophy C20
Physics K15
Physiology and Pharmacology C27
Political Science C20
Printing Section C22
Professional Development Centre E15
Professional Studies *(Faculty Office)* G2
Psychology F23
Publications Section C22
Remote Sensing K17
Research Office: 34-36 Botany Street Randwick
Safety Science B11a
Science *(Faculty Office)* E12
Science and Technology Studies C20
Social Science and Policy C20
Social Policy Research Centre F25
Social Work G2
Sociology C20
Spanish and Latin American Studies C20
Sport and Recreation Centre B6
Squash Courts B7
Student Centre *(off Library Lawn)* C22
Student Services:
Careers, Loans, Housing etc E15
Counselling E15
Students' Guild E15
Swimming Pool B4
Textile Technology G14
Theatre and Film Studies B10
Town Planning K15
WHO Regional Training Centre C27
Wool and Animal Sciences G14
Works and Maintenance B14A