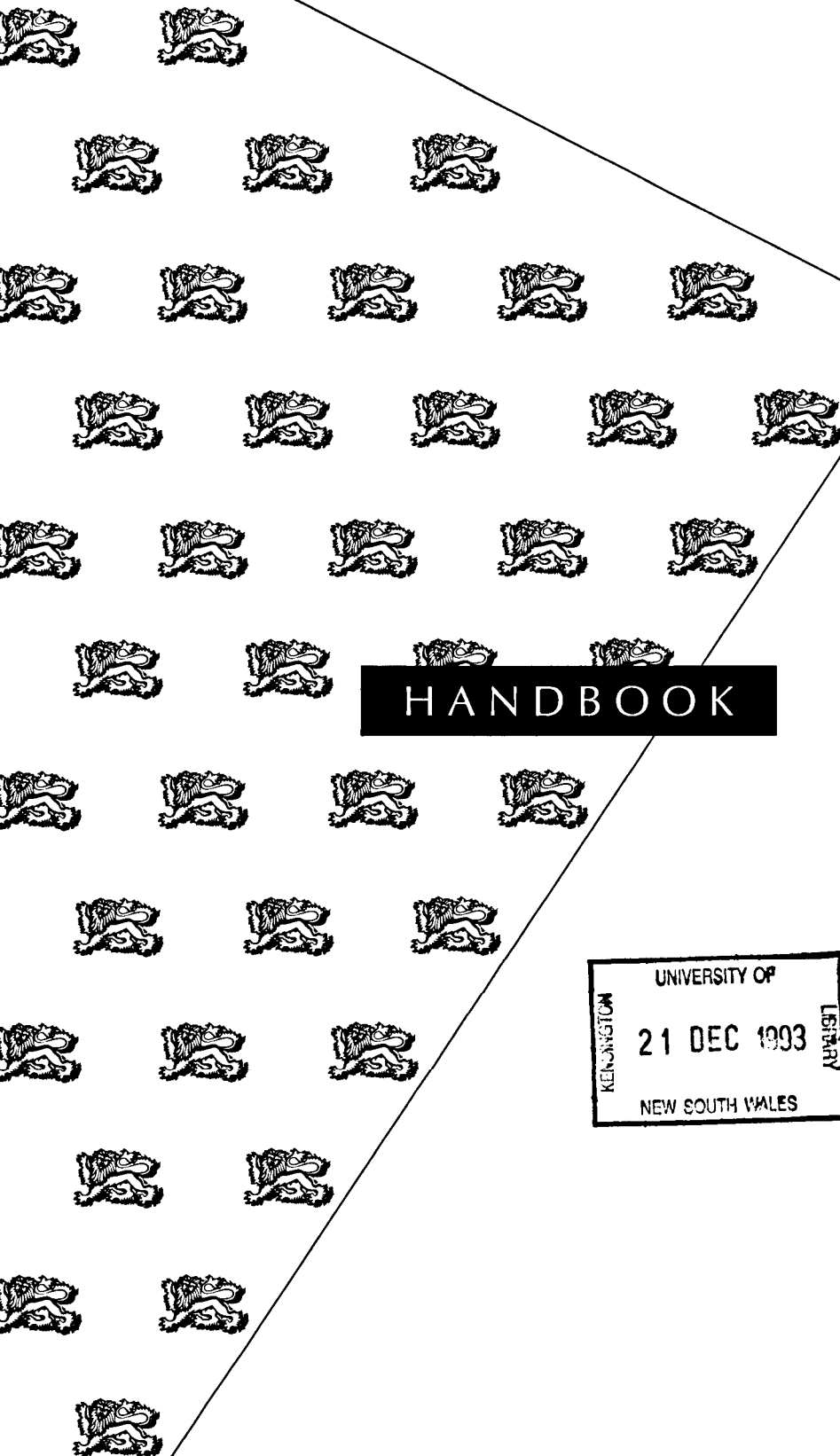
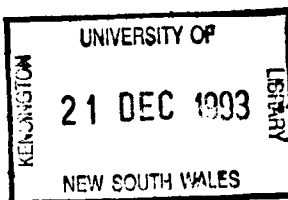


HANDBOOK

1994
APPLIED
SCIENCE



HANDBOOK



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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 1993, but may be amended without notice by the University Council.

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

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Introduction

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.

Undergraduate courses available are:

- Applied Geology (including specialization 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 (Engineering, Science, and Law). Students should discuss their programs with appropriate staff to ensure that their chosen course of study is appropriate to their aims and aspirations.

In 1991 an independent Department of Safety Science was established in the Faculty. This department specializes in multidisciplinary postgraduate training and research in a wide range of industrial and community safety issues.

The importance of applied science to the University of New South Wales, and to the wider community, is fully recognized and is especially referred to in the University Act of Incorporation. The Faculty of Applied Science is dynamic, with changing activities and programmes 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 programme 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.

G.J.S. Govett
Dean
Faculty of Applied Science

Calendar of Dates

The Academic year is divided into two sessions each containing 14 weeks for teaching. There is a recess of approximately six weeks between the two sessions and there are short recesses of one week within each of the sessions.

Session 1 commences on the Monday nearest 1 March.

All Faculties (other than Medicine)

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

Important Dates for 1994

January

M	3	New Year's Day Public Holiday
M	10	Term 1 begins - Medicine IV
M	17	Term 1 begins - Medicine V
W	26	Australia Day - Public Holiday

February

T	1	Enrolment period begins for new undergraduate students and undergraduate students repeating first year.
M	7	Re-enrolment period begins for second and later year undergraduate and graduate students enrolled in formal courses. Students should consult the Re-enrolling 1994 leaflets applicable to their courses for details.
M	14	Semester 1 begins - AGSM Graduate Management Qualification

M	21	Semester 1 begins - AGSM Graduate Diploma in Management
F	25	Term 1 begins - AGSM MBA Program, Year 1 classes Last day for acceptance of enrolment by new and re-enrolling students. (Late fee payable thereafter if enrolment approved.)
M	28	Session 1 begins - all courses except Medicine IV, V, VI Session 1 begins - University College, Australian Defence Force Academy Term 1 begins - AGSM MBA Program, Year 2 classes

March

M	7	Term 1 begins - Australian Graduate School of Management
F	11	Term 2 begins - Medicine IV Last day applications are accepted from students to enrol in Session 1 or whole year subjects.
Su	13	Term 1 ends - Medicine IV

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M 14	Term 2 begins - Medicine VI
Su 20	Term 1 ends - Medicine V
M 28	Term 2 begins - Medicine V
Th 31	Last day for students to discontinue without failure subjects which extend over Session 1 only. HECS Census Date for Session 1

April

F 1	Good Friday - Public Holiday Mid-session Recess begins
S 2	Easter Saturday - Public Holiday
M 4	Easter Monday - Public Holiday
Su 10	Mid-session Recess ends
Su 17	Term 2 ends - Medicine VI
Su 24	Term 2 ends - Medicine IV
M 25	Anzac Day - Public Holiday
S 30	May Recess begins - University College

May

M 2	Term 3 begins - Medicine IV Term 3 begins - Medicine VI
F 6	Term 1 ends - AGSM MBA Program, all classes
M 9	Examination week begins - AGSM MBA Program, all classes
T 10	Publication of provisional timetable for June examinations.
S 14	Examination - AGSM Graduate Management Qualification
Su 15	May Recess ends - University College, Australian Defence Force Academy
W 18	Last day for students to advise of examination clashes.
Su 29	Term 2 ends - Medicine V
M 30	Term 2 begins - AGSM MBA Program, all classes
T 31	Publication of timetable for June examinations.

June

S 4	Final examination - AGSM Graduate Management Qualification Semester 1 ends - AGSM Graduate Management Qualification
M 6	Term 3 begins - Medicine V
F 10	Session 1 ends Semester 1 ends - AGSM Graduate Management Qualification
S 11	Study recess begins College of Fine Arts assessment week begins
Su 12	Term 3 ends - Medicine IV Term 3 ends - Medicine VI
M 13	Queen's Birthday Public Holiday
T 14	Term 4 begins - Medicine IV Term 4 begins - Medicine VI
Th 16	Study Recess ends
F 17	Examinations begin Session 1 ends - University College, Australian Defence Force Academy College of Fine Arts assessment week ends
S 18	Mid-year Recess begins - University College, Australian Defence Force Academy
M 20	Examinations begin - University College, Australian Defence Force Academy

July

S 2	Examinations end - University College
T 5	Examinations end
W 6	Mid-year Recess begins
M 11	Semester 2 begins - AGSM Graduate Diploma in Management
Su 17	Mid-year Recess ends - University College, Australian Defence Force Academy
M 18	Semester 2 begins - AGSM Graduate Management Qualification Session 2 begins - University College, Australian Defence Force Academy
Su 24	Mid-year Recess ends
M 25	Session 2 begins - all courses except Medicine IV, V, and VI

August

F 5	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. Term 2 ends - AGSM MBA Program, all classes
Su 7	Term 4 ends - Medicine IV Term 3 ends - Medicine V Term 4 ends - Medicine VI
M 8	Exam week begins - AGSM MBA Program, all classes
M 15	Term 5 begins - Medicine IV Term 4 begins - Medicine V Term 5 begins - Medicine VI
M 29	Term 3 begins - AGSM MBA Program, all classes
W 31	HECS Census Date for Session 2 Last date for students to discontinue without failure subjects which extend over Session 2 only.

September

S 24	Mid-session Recess begins September Recess begins - University College
Su 25	Term 5 ends - Medicine IV Term 5 ends - Medicine VI
M 26	Term 6 begins - Medicine IV Term 6 begins - Medicine VI
F 30	Closing date for applications to the Universities Admission Centre.

October

M 3	Labour Day Public Holiday Mid-session Recess ends September Recess ends - University College, Australian Defence Force Academy
T 4	Publication of provisional timetable for the November examinations.
W 12	Last day for students to advise of examination clashes.
S 15	Examination - AGSM Graduate Diploma in Management
Su 16	Term 4 ends - Medicine V
F 21	Session 2 ends - University College, Australian Defence Force Academy
M 24	Examinations begin - University College, Australian Defence Force Academy
T 25	Publication of timetable for November examinations.

November

F 4	Session 2 ends Term 3 ends - AGSM MBA Program, all classes
S 5	Study recess begins College of Fine Arts assessment week begins Final examination - AGSM Graduate Management Qualification
	Semester 2 ends - AGSM Graduate Management Qualification Examination - AGSM Graduate Diploma in Management Semester 2 ends - AGSM Graduate Diploma in Management
Su 6	Term 6 ends Medicine - IV Term 6 ends Medicine - VI
M 7	Exam week begins - AGSM MBA Program, all classes
Th 10	Study Recess ends
F 11	Examinations begin College of Fine Arts assessment week ends Examinations end - University College, Australian Defence Force Academy
T 29	Examinations end

December

Th 22	Last day for acceptance of applications by the Admissions Section for transfer to another undergraduate course within the University.
M 26	Christmas Day Holiday
T 27	Boxing Day 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- Bioengineering, Membrane and Separation Technology, Minerals Engineering, Particle and Catalyst Technologies and the Key Centre for Mines. The Faculty is also associated with the UNSW Groundwater Centre and Centre for Remote Sensing and Geographic Information Systems.

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Department of Fuel Technology

Head

Associate Professor G. D. Sergeant

Department of Industrial Chemistry

Head

Associate Professor M. P. Brungs

Department of Polymer Science

Head

Associate Professor R. P. Burford

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(in association with the Faculty of Science)

Director, Chemical Engineering

Professor A. G. Fane

Director, Biophysics

Professor H. G. Coster

Centre for Particle and Catalyst Technologies

Director

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Ronald Postle, BSc *UNSW*, PhD *Leeds*, CText, FTI, FAIP, Hon. Docteur, *Haute Alsace*

Associate Professor

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Senior Lecturers

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Lecturers

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Xungai Wang, BE *NITSTXian*, PhD *UNSW*

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School of Geography

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Professor of Geography

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Peter Krauklis, BSc PhD *UNSW*, MIEAust, MIM, CEng, CPEng
Oleg Ostrovski, Dip.Ing.(Met.) PhD DSc (MISA, Moscow)
Sviatoslav Antonovich Prokopovich, MSc *UNSW*, ASTC, CPEng, MIEAust

Lecturers

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Patrick Wong, BE PhD *UNSW*, MAutoIMM
Aibing Yu, BSc (Eng) MSc(Eng) *NEUTChina*, PhD *W'gong*

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Professional Officers

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Jerzy Jankowski, MSc PhD *Wroc.*
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Gerrit Neef, BSc *Lond.*, PhD *Well.*, FGS
Derecke Palmer, MSc *Syd.*
Peter Cyril Rickwood, BSc *Lond.*, PhD *Cape T.*, CChem, MRIC, MAusIMM

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Centre for Minerals Engineering

Director

Tam Tran, BSc PhD UNSW, ARACI, MAIME

Deputy Director and Senior Lecturer

Anthony Charles Partridge

Key Centre for Mines

Incorporates the University of New South Wales and the University of Wollongong

Director and Associate Professor

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Vacant

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Monier Professor of Safety Engineering and Head of Department

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Lecturer

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Visiting Lecturers

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Richard Christian Curnow, BE *Syd.*, BCom *UNSW*
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Centre for Remote Sensing and Geographic Information Systems

In association with the Faculty of Engineering.

Director

Andrew Kerr Skidmore, BSc PhD *A.N.U.*

Deputy Director

Ewan Gerald Masters, BSurv PhD *UNSW*, MISAust

UNSW Groundwater Centre

In association with the Faculty of Engineering.

Director

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

Senior Lecturer

J. Jankowski

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/unit 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:

C	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 organizational unit offering subjects to students in the Faculty of Applied Science follow.

Prefix	Organizational Unit	Faculty/Board
ABIO	School of Applied Bioscience	Applied Science
ACCT	School of Accounting	Commerce & Economics
ANAT	School of Anatomy	Medicine
APSE	Faculty of Applied Science	
BIOC	School of Biochemistry	Biological & Behavioural Sciences
BIOM	Centre for Biomedical Engineering	Engineering
BIOS	School of Biological Science	Biological & Behavioural Sciences
BIOT	Department of Biotechnology	Applied Science
CEIC	School of Chemical Engineering & Industrial Chemistry	Applied Science
CHEM	School of Chemistry	Science
CHEN	Department of Chemical Engineering	Applied Science
CIVL	School of Civil Engineering	Engineering
CMED	School of Community Medicine	Medicine
COMP	School of Computer Science & Engineering	Engineering
ECOH	Department of Economic History	Commerce & Economics
ECON	School of Economics, Departments of Econometrics and Economics	Commerce & Economics
ELEC	School of Electrical Engineering	Engineering
ENVS	Faculty of Biological & Behavioural Sciences	
FIBR	School of Fibre Science & Technology	Applied Science
FINS	School of Banking & Finance	Commerce & 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
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 & Economics
IROB	School of Industrial Relations & Organizational Behaviour	Commerce & Economics
KCME	Key Centre for Mines	Applied Science

Prefix	Organizational Unit	Faculty/Board
LAND	School of Landscape Architecture	Built Environment
LEGT	Department of Legal Studies & Taxation	Commerce & Economics
LIBS	School of Information, Library and Archive Studies	Professional Studies
MANF	School of Mechanical & Manufacturing Engineering	Engineering
MARK	School of Marketing	Commerce & Economics
MATH	School of Mathematics	Science
MATS	School of Materials Science & Engineering	Applied Science
MECH	School of Mechanical & Manufacturing Engineering	Engineering
MEED	School of Medical Education	Medicine
MICR	School of Microbiology & Immunology	Biological & 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 & Mathematics	
PHYS	School of Physics	Science
PLAN	School of Town Planning	Built Environment
POLY	Department of Polymer Science	Applied Science
PSYC	School of Psychology	Biological & Behavioural Sciences
PTRL	Department of Petroleum Engineering Studies	Applied Science
SAFE	Department of Safety Science	Applied Science
SOCI	School of Sociology	Arts & Social Sciences
SURV	School of Surveying	Engineering
TEXT	Department of Textile Technology	Applied Science
WOOL	Department of Wool & Animal Science	Applied Science

Faculty Information

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. 697 4469

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

Applied Geology Ms. Bruce, Administrative Assistant, Room 916, Applied Science Building. Tel. 697 4262

Biotechnology Ms R. Lee, Administrative Assistant, Room 110A, Biological Sciences Building. Tel. 697 2050

Chemical Engineering and Industrial Chemistry Ms L. Woodcock, Administrative Officer, Room 316, Applied Science Building. Tel. 697 4318.

Food Science and Technology Mr R. Greenwood, Administrative Officer, Room 115, Building B8A. Tel. 697 4364.

Geography Ms C. Bilic, Administrative Assistant, Room 143, Geography and Surveying. Tel. 697 4390.

Materials Science and Engineering Mr O. Andersen, Administrative Assistant, Room 110B, Materials Science and Engineering Building. Tel. 697 4436.

Mining Engineering Ms L. Henry, Administrative Assistant, Room 159C, Main Building. Tel. 697 4516.

Petroleum Engineering Ms J. Lippatt, Room 115, Petroleum Engineering Building. Tel. 697 5188.

Textile Technology Ms F. Colville, Administrative Officer, Room 102, Sir Robert Webster Building. Tel. 697 4477.

Wool and Animal Science Assoc. Professor J. Kennedy, Room 256, Sir Robert Webster Building. Tel. 697 4482.

Safety Science Ms B. Littlewood, Administrative Assistant, Hut B, 11a, Room 111. Tel. 697 4144.

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; specialized equipment; educational support; parking provisions; library assistance.

A Resource Guide for students and staff with disabilities and a map showing wheelchair access is available from the 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 697 5418 or at Student Services, Quadrangle Building.

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.

Enrolment Procedures

All students re-enrolling in 1993 should obtain a copy of the free leaflet *ReEnrolling in 1993* 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

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, and the Department of Safety Science. It is closely associated with the libraries of 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 the undergraduate collection.

Professional staff are available at the Reader Assistance Unit on Level 2 to provide reference services and to assist in the use of the catalogues. Instructional classes in the use of the online catalogue. Instructional classes in the use of the library and in specific subject material can be arranged through the Reader Assistance Unit.

Serials in the Biomedical Library are now shelved in alphabetical order by title and carry the prefix 'MB'.

Details about Biomedical Library books, serials and audiovisual material can be found in the Library Catalogue, (OPAC).

The Biomedical Library offers the following facilities: computerized literature searches; a wide range of Databases on CDROM; remote access to databases on CDROM and current contents throughout the campus; access to the Family Medicine Program (MCQ self assessment); interlibrary loans.

Biomedical Librarian: Monica Davis

The Physical Sciences Library

This library, situated on Levels 6 and 7 of the Library tower, caters for the information needs of staff, postgraduate and undergraduate students in the pure and applied sciences, engineering and architecture.

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

The Library provides reference, reader assistance and reader education services, including interlibrary loan, online search and CDROM facilities. Photocopying facilities are also available.

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

Physical Sciences Librarian: Rhonda Langford

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 programmed 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 programmed over six years of part-time study in the University whilst the student is employed in industry. The normal programs may be varied by the Head of the School in which the student is enrolled. The regulations governing the award of these degrees are as follows:

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

(1) comply with the requirements for admission;

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

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

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

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

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

General Education Requirement

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

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

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

The program requires students to undertake studies in three categories of the program: The key questions addressed by the Program are:

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

Course Requirement: 56 hours

1. Australia and the Development of the World Economy. How do we, can we, generate wealth?

2. Human Inequality. How can we, ought we, distribute wealth, status and power?

3. Science and Civilization. What steps should we take, and what policies should we adopt, in science and technology?

4. Ecosystems, Technology and Human Habitation. What effects do our wealth generating and technoscientific activities have on the environment?

5. Mass Media and Communication. What are the effects of the new mass media of communication?

6. Australian Society and Culture.. What are the key social and cultural influences on Australia today?

Category B: The Internal Context of Assumptions and Values: An introduction to, and a critical reflection upon,

the cultural bases of knowledge, belief, language, identity and purpose.

Course Requirement: 56 hours

1. The Self and Society. How do we define ourselves in relation to the larger human community?

2. Changing Conceptions of Human Nature and WellBeing. How do our conceptions of human nature and well being influence both individual and social behaviour?

3. The Pursuit of Human Rationality. What are the prevailing conceptions of and challenges to human rationality?

4. The Use of Language, Images and Symbols. How do language, images and symbols function as means and media of communication

5. The Computer: Its Impact, Significance and Uses What is the impact of the computer on human society and culture?

6. Beliefs, Values and the Search for Meaning. Which systems of belief and configurations of values are most conducive to the survival and enhancement of the human species and the planet earth?

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

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

Will these abilities be used, for example:

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

In the Faculty of Applied Science most undergraduates take a Faculty subject APSE0002 Social Issues in Applied Science in the 4th year of their course as partial satisfaction of the Category C requirement. Completion of the Category C requirement differs across the Faculty and the details are shown under each School's handbook entry.

Undergraduate Study: Course Outlines

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).

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, 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 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.

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.

Graduate Study: Course Outlines

Enrolment Procedures

All students enrolling in graduate courses should obtain a copy of the free leaflet *ReEnrolling 1993 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.

Graduate Study

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 (Industrial Safety), 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.

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.

The Faculty offers a course leading to the award of the degree of Master of Environmental Studies. 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 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 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 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 hygiene, safety management or safety engineering. Students are required to study for a minimum of eighteen months full-time or three years part-time.

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. The courses available for the Graduate Diploma are Arid Lands Management, Biochemical Engineering, Biotechnology, Corrosion Technology, Ergonomics, Food Technology, Mining and Mineral Engineering, Mining Management, Remote Sensing, Safety Sensing, Textile

Technology and Wool and Pastoral Sciences and Petroleum Engineering.

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 MBT Program is a joint program of the Faculties of Applied Science and Engineering. However, candidates enrol through the Faculty of Engineering. 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 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.

The two courses currently offered through the Graduate School of Engineering are the Master of Business and Technology and the Graduate Diploma in Industrial Management. Both are full fee paying courses.

These courses aim to produce fully professional engineers with advanced management training. The courses involve open learning principles, including a modular structure with manual-type text material which students work through in their free time and approximately 1.5 hours. tutorials per week. There are three levels of attainment each of which is recognized by a formal qualification; the Industrial Management Qualification (IMQ), the Graduate Diploma and the Master's Degree.

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

School of Applied Bioscience

Head of School
Professor P. P. Gray

Administrative Assistant
Ms R. Lee

The School consists of the Departments of Biotechnology and of Food Science and Technology.

Department of Biotechnology

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 & 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.

General Education Electives

For details of the General Education requirements see Faculty Information.

Department of Food Science and Technology

Food Technology is the understanding and application of basic sciences to the management of foods from the time of production, through processing and distribution, until their use by the consumer. It is concerned with food quality and quantity, with nutritional status and safety, and with means of production, processing, preservation, distribution and utilization.

A study of food science and technology brings many scientific disciplines into focus. Its basis is in areas of chemistry, biochemistry and microbiology, and its borders merge with those of agriculture, engineering, nutrition, commerce, psychology and law. Biotechnology has a role of increasing importance in food science and technology.

The food technologist acquires new knowledge by laboratory and process research, and applies it to the development of acceptable foods, beverages and food ingredients by optimum processes and equipment. Foods are studied in terms of their basic constituents and the changes they undergo when subjected to modern processing and distribution. The technologist is equally concerned with the development and selection of raw materials from agricultural, horticultural, animal and marine sources.

The food and beverage processing industry is the largest sector of Australian manufacturing industry. Internationally, food production, food processing and food service are amongst the largest and most stable industries in the world.

The challenges facing these industries include increasing the availability, variety, quality and quantity of foods in line with the needs and expectations of an ever-increasing world population. Thus, there is a demand at both national and international levels for professionally trained people who are prepared to accept responsibility for the quality and safety of human food.

The Department offers a four-year full-time course leading to the award of the degree of Bachelor of Science and 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 Royal Australian Chemical Institute, the Australian Institute of Food Science and Technology, and the US Institute of Food Technologists.

Graduate Diploma and Master of Applied Science courses in Food Technology of one year full-time or two years part-time are designed for graduates in science or agriculture wishing to familiarize themselves with the principles of food technology. Master of Applied Science courses in Food Microbiology and Food Engineering are also offered.

General Education Electives

For details of the General Education requirements see Faculty Information.

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.

		HPW	
Year 1		S1	S2
BIOS1011	Biology A	6	0
BIOS1021	Biology B	0	6
CHEM1002	Chemistry 1	6	6
MATH1032	Mathematics 1 or		
MATH1042	Higher Mathematics 1 or		
MATH1011	General Mathematics 1B and	6	6
MATH1021	General Mathematics 1C		
PHYS1002	Physics 1 or		
PHYS1022	Introductory Physics 1	6	6
Totalling		24	24

		HPW	
Year 2		S1	S2
BIOC2312	Principles of Biochemistry and Molecular Biology	6	6
CHEM2819	Physical Chemistry for Food and Fibre Science & Technology	0	6
CHEM2021	Organic Chemistry	5	1
CHEM2041	Chemical and Spectroscopic Analysis	0	6
FOOD3210	Introductory Nutrition	3	0
FOOD4210	Introductory Food Engineering	3	0
MATH2819	Statistics SA	2	2
MICR2218	Microbiology	6	2
Totalling		25	23

Year 3			
BIOT3041	Principles of Biotechnology	3	0
CHEM3926	Analytical Instrumentation	0	3
CHEM3929	Food Chemistry	6	0
FOOD1310	Food Preservation	6	0
FOOD1320	Plant Food Science	2	0
FOOD1330	Animal Food Science	3	0
FOOD1340	Quality Evaluation and Control	0	2
FOOD1350	Food Technology Laboratory	0	6
FOOD2310	Food Microbiology	4	0
FOOD3310	Nutrition	0	3
FOOD4310	Food Process Engineering	0	4
FOOD4320	Computer Applications	0	2
General Education Subject/s Category A		0	4
Totalling		24	24

Year 4			
APSE0002	Social Issues in Applied Science*	2	0
FOOD1400	Project	8	8
FOOD1410	Field Excursions	3	0
FOOD1420	Food Legislation	2	0
FOOD1430	Food Industry Management*	2	0
General Education Subject/s Category B		0	4
Totalling		17	12

*These subjects contribute to satisfaction of the Category C General Education requirement.

Plus three or more of the following electives to a total of not less than 8.5 hours per week (17 credits).

BIOT3051	Biotechnology Laboratory	0	3
CHEM3021	Organic Chemistry	0	6
FOOD1440	Food Quality and Product Development	0	6
FOOD1450	Food Processing Wastes	0	3
FOOD1460	Cereal Technology	6	0
FOOD1470	Postharvest Technology of Foods	6	0
FOOD2410	Advanced Food Microbiology	0	6
FOOD2420	Yeast Technology	3	0
FOOD3410	Advanced Nutrition	6	0
FOOD4410	Advanced Food Engineering	3	0
FOOD4420	Food Packaging	3	0
MANF0420	Production Management	6	0
MARK2012	Marketing Fundamentals	4	0
MARK2052	Marketing Research	0	4

or such other electives, to a total of not less than 8.5 hours per week, as approved by the Head of Department (17 credits).

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.

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 specialize 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 daytime classes, and substantial daytime 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	
Stages 1 and 2*		S1	S2
BIOS1011	Biology A	6	0
BIOS1021	Biology B	0	6
CHEM1002	Chemistry 1	6	6
MATH1032	Mathematics I or		
MATH1042	Higher Mathematics 1 or	6	6
MATH1011	General Mathematics 1B and		
MATH1021	General Mathematics 1C		
PHYS1002	Physics 1 or		
PHYS1022	Introductory Physics 1	6	6

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

Stage 3

BIOC2312	Principles of Biochemistry and Molecular Biology	6	6
CHEM2021	Organic Chemistry	5	1
CHEM2041	Chemical and Spectroscopic Analysis	0	6
Totalling		11	13

		HPW	
Stage 4		S1	S2
CHEM2819	Physical Chemistry for Food and Fibre Science & Technology	0	6
FOOD3210	Introductory Nutrition	3	0
FOOD4210	Introductory Food Engineering	3	0
MATH2819	Statistics SA	2	2
MICR2218	Microbiology	6	2
Totalling		14	10

Stage 5			
BIOT3041	Principles of Biotechnology	3	0
CHEM3929	Food Chemistry	6	0
FOOD2310	Food Microbiology	4	0
FOOD3310	Nutrition	0	3
FOOD4310	Food Process Engineering	0	4
FOOD4320	Computer Applications	0	2
General Education Subject/s Category A		0	4
Totalling		13	13

Stage 6			
CHEM3926	Analytical Instrumentation	0	3
FOOD1310	Food Preservation	6	0
FOOD1320	Plant Food Science	2	0
FOOD1330	Animal Food Science	3	0
FOOD1340	Quality Evaluation and Control	0	2
FOOD1350	Food Technology Laboratory	0	6
General Education Subject/s Category B		2	2
Totalling		13	13

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	
Year 1		S1	S2
BIOS1011	Biology A	6	0
BIOS1020	Biology B	0	6
CHEM1002	Chemistry 1	6	6
or both			
CHEM1101	Chemistry 1A	6	0
CHEM1201	Chemistry 1B	0	6
MATH1032	Mathematics 1	6	6
or			
MATH1042	Higher Mathematics 1	6	6
or both			
MATH1011	General Mathematics 1B	6	0
MATH1021	General Mathematics 1C	0	6
and an additional 2 level 1 units: recommended			
PHYS1002	Physics 1 or		
PHYS1022	Introductory Physics 1	6	6
or			
CHEN1020	Engineering 1CE	6	6
Totalling		24	24

Year 2			
BIOC2312	Principles of Biochemistry & Molecular Biology	6	6
BIOS2011	Evolutionary & Physiological Ecology	6	0
BIOS2021	Introductory Genetics	0	6
MICR2201	Introductory Microbiology	6	0
CHEM2021	Organic Chemistry	6	0
or			
CHEM2041	Chemical & Spectroscopic Analysis	0	6
plus 2 level 2 units		6	6
General Education Subject(s) (Category A)		2	2
Totalling		26	26

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

plus an additional 2 level 3 units to be selected from the following:

BIOC3111	Molecular Biology of Proteins	6	0
BIOC3271	Cellular Biochemistry & Control	0	6
MICR3051	Immunology 2	0	6
General Education Subject(s) Category B		2	2
Totalling		26	26

Year 4			
BIOT3031	Microbial Genetics	6	0
BIOT3021	Biotechnology B	0	6
BIOT4XXX	Research Project	18	18
General Education Subject(s) Category C		2	2
Totalling		26	26

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, Microbiology as 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	
Year 1		S1	S2
CHEM1002	Chemistry 1	6	6
CHEN1020	Engineering 1 CE*	6	6
MATH1032	Mathematics 1	6	6
PHYS1002	Physics 1	6	6
General Education Subject/s Category A		2	2
Totalling		26	26
Year 2			
BIOS1011	Biology A	6	0
CEIC2010	Instrumental Analysis	3	3
CEIC2020	Computing	1	2
CEIC2030	Applied Thermodynamics and Rate Processes	2.5	0
CEIC2040	Applied Electrochemical and Surface Properties	1.5	0
CHEN2010	Materials & Energy Balances	2	2
CHEN2020	Flow of Fluids	2	2
CHEN2030	Heat Transfer	0	3
CHEN2040	Mass Transfer Fundamentals	0	2
CHEN2051	Chemical Engineering Laboratory 1	3	2
ELEC0802	Electrical Power Engineering	0	3
MATH2021	Mathematics	2	2
MATH2819	Statistics SA	2	2
General Education Subject/s Category B		2	2
Totalling		27	25

Year 3

		HPW	
		S1	S2
BIOC2312	Principles of Biochemistry and Molecular Biology	6	6
BIOT3100	Fermentation Processes	0	2
CEIC3010	Reaction Engineering	0	3
CHEN3010	Engineering Thermodynamics	4	0
CHEN3020	Numerical Methods	0	3
CHEN3070	Process Control	0	2
CHEN3030	Fluids II	2	0
CHEN3040	Separation Processes	2	2
CHEN3050	Particle Mechanics	0	3
CHEN3060	Process Plant Engineering I	4	4
CHEN3080	Chemical Engineering Laboratory II	1.5	1.5
MICR2201	Introductory Microbiology	6	0
Totalling		25.5	26.5

Year 4

		HPW	
		S1	S2
APSE0002	Social Issues in Applied Science*	2	
BIOT4063	Research Project	2	10
BIOT4093	Biological Process Engineering	6	6
CHEN4070	Process Dynamics & Control	3	2
CHEN4060	Process Plant Engineering II	4	
CHEN4030	Safety & Environment*	2	
CHEN4050	Process Plant Operation		3
CHEN4040	Management	2	2
CHEN4080	Design Project*	1	4
CIVL0616	Structures	3	
Totalling		25	27

*These subjects contribute to satisfaction of the Category C General Education Requirement.

Subject Descriptions

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

APSE0002**Social Issues in Applied Science**

Staff Contact: Faculty Office

S1

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.

Department of Biotechnology

BIOT3011

Biotechnology A

Staff Contact: Prof N Dunn

S1 L3 T3

Prerequisite: BIOC2312

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 sterilization; 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

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 optimization 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 S Delaney

S1 L2 T4

Prerequisites: BIOS2011, BIOS2021, BIOC2312 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 transposable 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: Prof N Dunn

S1 L3

Prerequisites: BIOC2312 and MICR2218

Lecture component of BIOT3011 Biotechnology A

BIOT3051

Biotechnology Laboratory

Staff Contact: Prof N Dunn

S1 T3

Prerequisite: Biot3041

Laboratory component of BIOT3011 Biotechnology A.

BIOT3061

Monoclonal Antibody and Genetic Techniques in Biotechnology

Staff Contact: Dr S Mahler

S2 L2 T4

Prerequisite: BIOC2312

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

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 optimization and waste disposal. Demonstrations of the operation and control of fermenter systems and of microbial process simulation.

BIOT4063

Research Project

Staff Contact: Prof P Rogers

S1 T2 S2 T10

BIOT4073/BIOT4083

Biotechnology Honours

Staff Contact: Prof N Dunn

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

BIOT4093

Biological Process Engineering

Staff Contact: Department Office

F L2 T4

Prerequisite: MICR2201

Structure of Metabolism: Growth of an undifferentiated organism as a physicochemical process leading to quantification of growth processes. Structure and function of a single cell. The structure of metabolic processes. Energy metabolism balances. Small metabolite production. Macromolecule production. Coordination and control of cellular processes. *Industrial Bioprocesses*: A review of bioprocess industries. The selection, screening and maintenance of commercial cultures. The optimization of bioprocesses. Batch and continuous fermentations. Enzyme engineering, single cell protein. Biodeterioration and microbiological stability. Sanitation. Fermentation practice. *Microbial Dynamics and Energetics*: Principles used in the quantification of complex systems. Quantification of biomass and the growth process. Balanced growth. The Monod model and further extensions of the model. Uncoupling of growth processes. Quantification of product formation. Distributed, segregated, unstructured and structured models. Stochastic models. Overall energetics of growth processes. Entropy and free energy relationships in complex reaction sequences. Principles and requirements of driven reactions. The energetics of cell processes and the prediction of yields and metabolic heat evolution.

Department of Food Science and Technology

FOOD1310

Food Preservation

Staff Contact: Prof K. A. Buckle

S1 L3 T3

Prerequisites: BIOC2312, 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, ionizing 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 C.M.C. Yuen

S1 L2

Prerequisites: BIOC2312, 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 postharvest physiology, storage and handling. *Lipids*: Sources and composition of fats and oils, methods of extraction and processing. *Nonmicrobial 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 J.E. Paton

S1 L3

Prerequisites: BIOC2312, 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 meatderived products; processing equipment; meat marketing systems; nutritional and sensory properties of meats. *Milk and dairy products*: Chemical, physical properties, microbiology of milk; technology of milkderived products including cheese, fermented products, butter; frozen, chilled and dried milkderived 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, marinating 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

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 J.E. Paton

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: A/Prof G.H. Fleet

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 K.A. Buckle*

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 K.A. Buckle*

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: Prof K.A. Buckle*

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*

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 K.A. Buckle*

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: Dr J. Arcot*

S1 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. Nonfood uses of cereals. Preparation and uses of cereal protein, starches and lipids.

FOOD1470**Postharvest Technology of Foods***Staff Contact: Dr C.M.C. Yuen*

S1 L2 T4

Prerequisite: FOOD1350

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

FOOD2310**Food Microbiology***Staff Contact: A/Prof G.H. Fleet*

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 foodborne 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; sublethal injury; standard methods for determination of total plate counts, indicator organisms, foodborne 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 G.H. Fleet*

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, foodborne 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 G.H. Fleet*

S1 L2 T1

*Prerequisite: FOOD2310**Note/s: Not offered in 1994*

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.

FOOD3210**Introductory Nutrition***Staff Contact: A/Prof H. Greenfield*

S1 L2 T1

Co or Prerequisite: BIOC2312

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*

S2 L2 T1

Prerequisite: 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 undernutrition 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.

FOOD3410**Advanced Nutrition***Staff Contact: A/Prof H. Greenfield*

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.

FOOD4210**Introductory Food Engineering***Staff Contact: Ms J.L. Paterson*

S1 L2 T1

Prerequisites: PHYS1002 or PHYS1022 and MATH1032 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 R.H. Driscoll*

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 R.H. Driscoll*

S2 L1 T1

Prerequisite: MATH2819

Introduction to VAX/VMS, VM/CMS, MSDOS and other control languages. The use of statistical, graphics and other program packages to solve problems in food science and technology.

FOOD4420**Food Packaging***Staff Contact: Dr R.H. Driscoll*

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 R.H. Driscoll*

C3 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 R.H. Driscoll*

C3 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.

Graduate Study

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

In addition, the School welcomes enquiries from graduates in Chemistry, Biochemistry, Microbiology, Applied Science, Chemical Engineering, Physiology, Nutrition and Agriculture who are interested in pursuing research in

biotechnology or in food science and technology for the award of the degrees of Master of Science and Doctor of Philosophy.

The Head of School 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

Department of Biotechnology

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.

Elective Subjects

HPW

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

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

8042

Master of Applied Science (Biotechnology) Graduate Course

Master of Applied Science (Biotechnology) MAppSc(Biotech)

The Department offers a formal graduate course at the masters' level. 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:

Compulsory Subjects

HPW

		S1	S2
BIOT3011	Biotechnology A	6	0
BIOT3021	Biotechnology B	0	6
BIOT5013	Practical Biotechnology	6	6

		HPW	
		S1	S2
BIOT7043	Biotechnology Project Major	8	8
BIOT7051	Applied Genetics	0	5
BIOT7061	Peptide and Protein Technology	0	5
BIOT7071	Biochemical Engineering	0	5
BIOT7081	Environmental Biotechnology	5	0
BIOT7091	Applied Cellular Physiology	5	0
BIOT7100	Biological Principles	3	0
BIOT7110	Bioengineering Principles	3	0
BIOT7123	Biotechnology Project Minor	4	4

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.

Department of Food Science and Technology

The Department conducts formal courses leading to the award of the Master of Applied Science degree and of the Graduate Diploma in food technology.

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 **8030**
Food Microbiology Course **8031**
Food Engineering Course **8035**

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 36 credits (1 credit equals 1 hour of class contact per week for one session) made up of compulsory subjects, a compulsory project (either 6 or 12 or 18 credits) 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 18 credits each) or two years of part-time study (normally four sessions of 9 credits 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.

8030

Food Technology Graduate Course

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

FOOD1527	Principles of Food Preservation	6
FOOD1557	Food Technology Laboratory	6
FOOD1707	Seminar	2

Compulsory Project

Either		
FOOD1717	Major Research Project	18
or		
FOOD1727	Research Project	12
or		
FOOD1737	Minor Project	6

* These credits 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.

Compulsory Subjects

FOOD2597	Food Microbiology Seminar	2
FOOD2517	Food Microbiology	4
FOOD2527	Microbiological Examination of Foods	6
FOOD2537	Microbiological Quality Assurance	2

Compulsory Project

Either		
FOOD2617	Major Research Project in Food Microbiology	18
or		
FOOD2607	Food Microbiology Research Project	12
or		
FOOD2547	Food Microbiology Project	6

Elective Subjects

FOOD1517	Chemistry, Biochemistry and Physics of Foods	3
FOOD1527	Principles of Food Preservation	6
FOOD2507	Introductory Microbiology	3
FOOD2557	Microbial Spoilage of Foods	1
FOOD2567	Foodborne Microorganisms of Public Health Significance	2
FOOD2577	Food and Beverage Fermentations	2
FOOD2587	Microorganisms as Food Processing Aids and Ingredients	1

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.

* Credits may be concentrated in one session.

8031 Food Microbiology Graduate Course

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:

8035 Food Engineering Graduate Course

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

FOOD1707	Seminar	2
FOOD4557	Food Engineering Laboratory	3
FOOD4567	Food Engineering Field Work	3
FOOD4587	Advanced Food Engineering A	4
FOOD4597	Advanced Food Engineering B	4
FOOD4607	Packaging and Production	4

Compulsory Project**C**

Either

FOOD1717 Major Research Project

18

or

FOOD1727 Research Project

12

or

FOOD1737 Minor Project

6

** Credits 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 (34 credits, 1 credit equals 1 hour of class contact per week for one session), or two years of part-time study (17 credits/year). It involves the following program:

Compulsory Subjects**C***

FOOD1527	Principles of Food Preservation	6
FOOD1537	Plant Food Products	2
FOOD1547	Animal Food Products	3
FOOD1557	Food Technology Laboratory	6
FOOD2517	Food Microbiology	4

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.

** Credits 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 organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

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

BIOT7010**Reading List in Biotechnology (Microbiology)***Staff Contact: Prof N Dunn*

S1 or S2 T3

BIOT7020**Reading List in Biotechnology (Biochemistry)***Staff Contact: Prof N Dunn*

S1 or S2 T3

BIOT5013**Practical Biotechnology***Staff Contact: Department Office*

F T6

Illustration, demonstration and operation of laboratoryscale and pilotscale equipment. Visits to appropriate industries. Experimental project or critical review.

BIOT7043**Biotechnology Project (Major)***Staff Contact: Department Office*

F T8

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

Department of Biotechnology**BIOT8010****Graduate Seminars***Staff Contact: Department Office*

F T2

BIOT7051**Applied Genetics**

Staff Contact: Prof N Dunn
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.

BIOT7061**Peptide and Protein Technology**

Staff Contact: Dr S Mahler
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; immobilization 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
S2 L2 T3

Design of bioreactors; range of biocatalysts from free enzymes to immobilized cells; heat and mass transfer, scaleup, 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 computerlinked 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
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, cellulose, aromatics, hydrocarbons and wastewater treatment. Students present research reviews and conduct experimental projects.

BIOT7091**Applied Cellular Physiology**

Staff Contact: Department Office
S1 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 S Delaney
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: Department Office
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*

F T4

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

Department of Food Science and Technology

FOOD1507**Introductory Food Science***Staff Contact: Prof K.A. Buckle*

C2 S1 L1 S2 T1

An introduction to the history of food preservation and human nutrition. Current world food patterns, organizations 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 K.A. Buckle*

C3 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 K.A. Buckle*

C6 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, ionizing 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 C.M.C. Yuen*

C2 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 postharvest 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 J.E. Paton*

C3 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, marinating 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 J.E. Paton*

C6 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*

C2 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 K.A. Buckle*

C2 S2 L2

Prerequisite: FOOD1547 or equivalent*Note/s:* Not offered in 1994

World fisheries, oceanographic factors and fish populations. Biochemistry and microbiology of growth, culture, harvesting and postharvest 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*

C2 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 C.M.C. Yuen*

C6 S1 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 nonclimacteric 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 postharvest tissue; physical and chemical methods of control; postharvest disinfestation and quarantine measures. Examination of current commercial storage and marketing operations.

FOOD1667**Postharvest Storage of Foods***Staff Contact: Dr C.M.C. Yuen*

C6 S1 L2 T4

Prerequisite: FOOD1557 or equivalent

Preharvest considerations, postharvest physiology and biochemistry, postharvest factors affecting quality, methods of storage and handling, marketing strategies for selected food commodities.

FOOD1707**Seminar***Staff Contact: Dr C.M.C. Yuen*

C2 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 K.A. Buckle*

C18 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 K.A. Buckle*

C12 F T6

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

FOOD1737**Minor Project***Staff Contact: Prof K.A. Buckle*

C6 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 K.A. Buckle*

C6 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 K.A. Buckle*

C3 S1 or S2 T3

A similar but shorter investigation to that outlined in FOOD1747.

FOOD1767**Reading Assignment***Staff Contact: Prof K.A. Buckle*

C1 SS T1

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

FOOD2507**Introductory Microbiology***Staff Contact: A/Prof G.H. Fleet*

C3 S1 L2 T2

Note/s: Not offered in 1994

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 G.H. Fleet*

C4 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 foodborne 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; sublethal injury; standard methods for determination of total plate counts, indicator organisms, foodborne 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 G.H. Fleet

C6 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, DNAprobe, 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 B.A. Munce

C2 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 G.H. Fleet

C6 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 B.A. Munce

C1 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 shelflife; biochemical basis of spoilage defects, taints; predictive considerations.

FOOD2567

Foodborne Microorganisms of Public Health

Significance

Staff Contact: Dr B.A. Munce

C2 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 G.H. Fleet

C2 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 G.H. Fleet

C1 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, immobilized cell and cell reactor technologies for conducting food and beverage bioconversions.

FOOD2597

Food Microbiology Seminar

Staff Contact: Dr B.A. Munce

C2 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 G.H. Fleet

C12 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 G.H. Fleet

C18 F T9

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

FOOD3507

Introductory Nutrition

Staff Contact: A/Prof H. Greenfield

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

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 undernutrition 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

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.

FOOD4507

Food Engineering Principles

Staff Contact: Ms J.L. Paterson

C3 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 R.H. Driscoll

C4 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 R.H. Driscoll

C2 S2 L1 T1

Prerequisite: An introductory statistics subject or equivalent

Introduction to VAX/VMS, VM/CMS, MSDOS and other control languages; the use of statistical, graphics and other program packages to solve problems in food science and technology.

FOOD4557

Food Engineering Laboratory

Staff Contact: Ms J.L. Paterson

C3 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: Dr R.H. Driscoll

C3 S1 T3

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

FOOD4587

Advanced Food Engineering A

Staff Contact: Dr R.H. Driscoll

C4 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 R.H. Driscoll

C4 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: Dr R.H. Driscoll

C4 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.

School of Chemical Engineering and Industrial Chemistry

Head of School

Professor D.L. Trimm

Administrative Officer

Ms L.A. Woodcock

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* 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 utilization of fuels and energy.

Industrial Chemistry is the discipline in which the scientific work of the research chemist is translated into the activities of the chemical industry. The thermodynamic feasibility of a reaction in inorganic or organic chemistry, the conditions under which the reaction might proceed, the kinetics of the reaction and the means whereby the reaction might be controlled to produce the desired product are the fundamentals of the course.

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.

**in conjunction with the School of Mines and School of Materials Science and Engineering.*

Undergraduate Study

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.

		HPW	
Year 1		S1	S2
CHEM1002	Chemistry 1	6	6
CHEN1020	Engineering 1 CE†	6	6
MATH1032	Mathematics 1	6	6
PHYS1002	Physics 1	6	6
General Education Subject Category A		0	2
Totalling		24	26

		HPW	
Year 2		S1	S2
CEIC2010	Instrumental Analysis	3	3
CEIC2020	Computing	1	2
CEIC2030	Applied Thermodynamics and Rate Processes	2.5	0
CEIC2040	Applied Electrochemical and Surface Processes	1.5	0
CHEM2828	Organic and Inorganic Chemistry (for Chemical Engineers)	4	0
CHEN2010	Material and Energy Balances	2	2
CHEN2020	Flow of Fluids	2	2
CHEN2030	Heat Transfer	0	3
CHEN2040	Mass Transfer Fundamentals	0	2
CHEN2050	Chemical Engineering Laboratory 1	0	2
ELEC0802	Electrical Power Engineering	0	3
INDC2050	Physical Process Laboratory	2	0
MATH2021	Mathematics	2	2
MATH2819	Statistics SA	2	2
General Education Subject/s		2	2
Totalling		24	25

HPW

Year 3		S1	S2
CEIC3010	Reaction Engineering	0	3
CHEN3010	Engineering Thermodynamics	4	0
CHEN3020	Numerical Methods	0	3
CHEN3030	Fluids 2	2	0
CHEN3040	Separation Processes 1	2	2
CHEN3050	Particle Mechanics	0	3
CHEN3060	Process Plant Engineering 1	4	4
CHEN3070	Process Control	0	2
CHEN3080	Chemical Engineering Laboratory 2	1.5	1.5
CHEN3090	Chemical Engineering Applications*	4	4
CIVL0616	Structures	3	0
MATH3021	Mathematics	2	2
General Education Subject		2	0
Totalling		24.5	24.5

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

Year 4		S1	S2
APSE0002	Social Issues in Applied Science	2	0
CHEN4010	Separation Processes 2	2	0
CHEN4020	Advanced Reaction Engineering*	2	0
CHEN4030	Safety and Environmental†	2	0
CHEN4040	Management	2	2
CHEN4050	Process Plant Operation*	0	3
CHEN4060	Process Plant Engineering 2	4	0
CHEN4070	Process Dynamics and Control	3	2
CHEN4080	Design Project†	1	4
CHEN4090	Research Project*	2	10
CHEN4100	Professional Electives*	3	3
Totalling		23	24

(*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 Category C 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 utilization 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 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.

		HPW	
		S1	S2
Year 3			
FUEL3010		4	4
Year 4			
FUEL4010		9	4

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, CHEN4090 Research Project, CHEN4020 Advanced Reaction Engineering, CHEN4030 Safety and Environmental, CHEN4050 Process Plant Operation, CHEN4100 Professional Electives. This elective may qualify graduates for membership of the Australian Institute of Mining and Metallurgy.

		HPW	
		S1	S2
Year 3			
MINE0130	Principles of Mining	2	0
MINE3101	Mineral Process Engineering	2	2
MINP4010	Hydrometallurgical Processes	2	0
Year 4			
GEOL5410	Mineralogy for Mineral Engineering	0	2
MATS9650	Pyrometallurgical Processes	2	0
MINP4020	Hydrometallurgy Practices	3	0
MINP4030	Hydrometallurgical Process Engineering	0	2
MINE4101	Mineral Processing Practices	2	0
MINE4401	Mine Waste Disposal & the Environment	0	2
MINE4402	Mineral Engineering Project	0	8

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	S2
Stage 1			
MATH1032	Mathematics 1	6	6
PHYS1002	Physics 1	6	6
Totalling		12	12
Stage 2			
CEIC1020	Engineering 1CE	6	6
CHEM1002	Chemistry 1	6	6
General Studies subject		2	0
Totalling		14	12
Stage 3			
CEIC2010	Instrumental Analysis	3	3
CEIC2020	Computing	1	2
CEIC2030	Applied Thermodynamics and Rate Processes	2.5	0
CEIC2040	Applied Electrochemical and Surface Processes	1.5	0
ELEC0802	Electrical Power Engineering	0	3
INDC2050	Physical Processes Laboratory	2	0
MATH2021	Mathematics	2	2
MATH2819	Statistics SA	2	2
Totalling		14	12
Stage 4			
CHEM2828	Organic and Inorganic Chemistry	4	0
CHEM2010	Material and Energy Balances	2	2
CHEM2020	Flow of Fluids	2	2
CHEM2030	Heat Transfer	0	3
CHEM2040	Mass Transfer Fundamentals	0	2
CHEM2050	Chemical Engineering Laboratory I	1	2
General Education Subject		2	2
Totalling		11	13
Stage 5			
CHEM3010	Engineering Thermodynamics	4	0
CHEM3020	Numerical Methods	0	3
CHEM3050	Particle Mechanics	0	3
CHEM3090	Chemical Engineering Applications	4	4
CHEM4040	Management	2	2
MATH3021	Mathematics	2	2
Totalling		12	14
Stage 6			
CEIC3010	Reaction Engineering	0	3
CHEM3030	Fluids II	2	0
CHEM3040	Separation Process I	2	2
CHEM3060	Process Plant Engineering I	4	4
CHEM3070	Process Control	0	2
CHEM3080	Chemical Engineering Laboratory II	1.5	1.5
General Education Subject		2	0
Totalling		11.5	12.5

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	
Year 1		S1	S2
CHEM1002	Chemistry 1	6	6
INDC1020	Engineering 1 IC	6	6
MATH1032	Mathematics 1	6	6
PHYS1002	Physics 1	6	6
Totalling		24	24

Year 2			
CEIC2010	Instrumental Analysis	3	3
CEIC2020	Computing	1	2
CEIC2030	Applied Thermodynamics and Rate Processes	2.5	0
CEIC2040	Applied Electrochemical and Surface Processes	1.5	0
CHEM2021	Organic Chemistry	2	4
CHEM2031	Inorganic Chemistry	0	6
INDC2010	Mass and Energy Balances	2	0
INDC2020	Introduction to Fluid Flow	2	1
INDC2030	Heat Transfer and Temperature Measurement	0	2
INDC2050	Physical Processes Laboratory	2	0
MATH2021	Mathematics	2	2
MATH2819	Statistics SA	2	2
PHYS2920	Electronics	3	0
General Education Subject Category A		0	2
Totalling		23	24

Year 3			
CEIC3010	Reaction Engineering	0	3
CHEM3829	Organic Chemistry	6	0
INDC3010	Thermodynamics	3	0
INDC3021	Numerical Methods	0	2
INDC3031	Experimental Design	2	1
INDC3041	Corrosion in the Chemical Industry	0	3
INDC3050	Chemistry of High Temperature Materials	0	2
INDC3060	Unit Operations	2	0
INDC3070	Instrumentation and Process Control 1	0	3
INDC3080	Instrumental Analysis 2	4	0
INDC3090	Chemistry of Industrial Processes	3	3
POLY3010	Polymer Science	2	4
General Education Subject/s		2	2
Totalling		24	23

HPW

Year 4		S1	S2
APSE0002	Social Issues in Applied Science	2	0
BIOT3100	Fermentation Processes	0	2
CEIC4010	Process Economics 1	1	0
CEIC4020	Process Economics 2	0	1
INDC4010	Applied Thermodynamics	2	0
INDC4020	Applied Kinetics	2	0
INDC4040	Management	0	2
INDC4070	Laboratory Automation Science	4	0
INDC4080	Seminars	2	2
INDC4090	Project	8	16
INDC4120	Chemistry of the Industrial Environment	3	0
POLY4010	Advanced Polymer Science	2	0
General Education Subject Category B		0	2
Totalling		26	25

These subjects contribute towards satisfaction of the Category C General Education requirement.

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

Stages 1 and 2*		S1	S2
CHEM1002	Chemistry 1	6	6
INDC1020	Engineering 1 IC	6	6
MATH1032	Mathematics 1	6	6
PHYS1002	Physics 1	6	6
Totalling		24	24

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

Stage 3

CEIC2010	Instrumental Analysis	3	3
CEIC2030	Applied Thermodynamics & Rate Processes	2.5	0
CEIC2040	Applied Electrochemical & Surface Processes	1.5	0
INDC2050	Physical Processes Laboratory	2	0
MATH2021	Mathematics	2	2
MATH2819	Statistics SA	2	2
General Education Subject/s Category A		2	2
Totalling		15	9

Stage 4

CEIC2020	Computing	1	1
CHEM2021	Organic Chemistry	6	0
CHEM2031	Inorganic Chemistry	0	6
INDC2020	Introduction to Fluid Flow	2	0
INDC2010	Mass and Energy Balances	2	0
INDC2030	Heat Transfer and Temperature Measurement	0	2
PHYS2920	Electronics	3	0
Totalling		14	9

		HPW	
Stage 5		S1	S2
CEIC3010	Reaction Engineering	0	3
INDC3010	Thermodynamics	3	0
INDC3021	Numerical Methods	0	2
INDC3031	Experimental Design	2	1
INDC3041	Corrosion in the Chemical Industry	0	3
INDC3050	Chemistry of High Temperature Materials	0	2
INDC3060	Unit Operations	2	0
INDC3080	Instrumental Analysis 2	4	0
General Education Subject/s Category B		2	2
Totalling		13	13

		HPW	
Stage 6		S1	S2
CHEM3829	Organic Chemistry	6	0
INDC3070	Instrumentation and Process Control 1	0	3
INDC3090	Chemistry of Industrial Processes	3	3
POLY3010	Polymer Science	2	4
Totalling		11	10

Subject Descriptions

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

Students are expected to possess a calculator having exponential capabilities (In 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.

APSE0002

Social Issues in Applied Science

Staff Contact: School Office

S1

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.

Chemical Engineering and Industrial Chemistry

CEIC2010

Instrumental Analysis

Staff Contact: A/Prof M. Brungs

F L1 T2

Prerequisites: PHYS1002, CHEM1002, MATH1032, 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 absorption, X ray diffraction and fluorescence. Chromatographic analysis, gas chromatography, high performance liquid chromatography, and ion chromatography.

CEIC2020

Computing

Staff Contact: Dr T. Pham

S1 L1 S2 L1 T1

Prerequisites: MATH1032, CHEM1002, 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: Dr R. Chaplin

S1 L1.5 T1

Prerequisites: PHYS1002, CHEM1002 or CHEM1102 and CHEM1201, MATH1032, 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: Dr R. Chaplin

S1 L1.5

Prerequisites: PHYS1002, CHEM1102 and CHEM1201, MATH1032, 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: A/Prof N. Foster

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, optimization 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 nonadiabatic 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

S1 L1

Consists of the segment Process Economics CHEN3060 Process Plant Engineering 1

CEIC4020**Process Plant Economics 2**

Staff Contact: Dr T. Tran

S2 L1

Consists of the segment Process Economics 2 from CHEN4060 Process Plant Engineering 2

CEIC4200**Industrial Experience**

Staff Contact: Dr C. Dixon

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

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.

CHEN1010**Introduction to Chemical Engineering**

Staff Contact: Dr D. Wiley

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 stoichiometry. Introduction to material balancing. Process calculations associated with gases, vapours and liquids.

CHEN1020**Engineering 1 CE**

Staff Contact: Dr C. Dixon

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: Dr E. Curry-Hyde

F L1 T1

Prerequisites: CHEM1020, CHEN1020, MATH1032, 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: A/Prof J. Raper*

F L1 T1

Prerequisites: PHYS1002, CHEN1020, CHEM1002, MATH1032

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 C. Jones*

S2 L2 T1

Prerequisites: PHYS1002, CHEN1020, CHEM1002, MATH1032

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*

S2 L1 T1

Prerequisites: PHYS1002, CHEM1002, CHEN1020, MATH1032

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: A/Prof N. Foster*

S1 T3 S2 T2

Prerequisites: PHYS1002, CHEM1002, CHEN1020, MATH1032

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*

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**Numerical Methods***Staff Contact: Dr H. Preisig*

S1 L1 S2 L1 T1

Prerequisites: CEIC2020, MATH2021, MATH2819

Basic concepts of numerical methods. Solution of single and multiple, linear and non-linear, non-differential equations. Numerical solutions of ordinary differential equations. Optimization techniques: single and multiple dimensional search, linear programming, dynamic programming. Use of subroutine libraries. Application to process industry problems.

CHEN3030**Fluids 2***Staff Contact: Dr T. Pham*

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***Staff Contact: A/Prof N. Foster*

F L1 T1

Prerequisites: CEIC2030, CEIC2040, CHEN2010, CHEN2020, CHEN2030, CHEN2040, CHEN2050

Stagewise Processes: Phase equilibrium. Absorption. Binary distillation. Liquidliquid 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*

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

FL3 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 offsites 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.

CHEN3070

Process Control

Staff Contact: Dr C. Dixon

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: A/Prof N. Foster

FT1.5

Prerequisites: CHEM2828, CHEM2011, CEIC2010, CEIC2020, CHEN2010, CHEN2020, CHEN2030, 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

FL2 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

Multicomponent Separation Processes

Staff Contact: Dr R. Amal

S1 L1 T1

Prerequisite: CHEN3010, CHEN3020, CHEN3040, MATH3021

Separation of multicomponent systems by stagewise operations. Multicomponent 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

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

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.

CHEN4040

Management

Staff Contact: Prof A. Fane

FL2

Prerequisite: CHEN3060

This course will consider (i) the management of operating plant and (ii) project management of process plant projects. (i) Plant Management: company types, structure and organisation. Company financing and operation. Personnel management. Cost accounting. Company law, industrial relations and trade union practices. (ii) Project management: role and responsibilities of project management. Project organisation. Planning and

scheduling. Cost control. Project scheduling. Project trending and performance.

CHEN4050

Process Plant Operation

Staff Contact: A/Prof R. Wood

S2 L1 T2

Prerequisite: All 3rd year subjects

Practical studies of the operation of computer controlled chemical plant. Process diagnostics. Troubleshooting.

CHEN4060

Process Plant Engineering 2

Staff Contact: Dr T. Tran

S1 L2 T2

Prerequisites: CHEN3060, CHEN3070

Process Engineering II: Process Synthesis and analysis techniques for process sequence selection. Heat exchanger networks. Optimum energy utilisation methods. Process simulation for steady and unsteady state. Project Engineering II: All activities required from the finalisation of the process flow diagram for a process plant through the development of P and ID's, plant design and engineering, construction, commissioning and operation. Project management and process contracting. Economics II: Project economic evaluation. Discounted cash flow methods. Project financing. Sensitivity analysis and uncertainty. Financial and cost accounting methods.

CHEN4070

Process Dynamics and Control

Staff Contact: Dr C. Dixon

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 multivariable control.

CHEN4080

Design Project

Staff Contact: Prof A. Fane

S1 T1 S2 T4

Prerequisite: All 3rd year 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

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

F L2 T1

Prerequisite: All 3rd year 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.

INDC1010

Industrial Chemistry I

Staff Contact: Dr D. Wiley

F L1 T1

Prerequisites: PHYS1002, MATH1032

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

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

S1 L1 T1

Prerequisites: CHEM1002, INDC1020, MATH1032, 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: A/Prof J. Raper

S1 T2 S2 L1

Prerequisites: PHYS1002, MATH1032, CHEM1002, 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 C. Jones

S2 L1 T1

Prerequisites: PHYS1002, MATH1032, CHEM1002, 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

S1 T2

Prerequisites: PHYS1002 (or CHEM1002), CHEM1102, CHEM1201, MATH1032, 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

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 homogeneous mixtures. Chemical reaction equilibria; calculation of equilibrium compositions for single reactions. Phase equilibria; the phase rule, equilibrium.

INDC3021

Numerical Methods

Staff Contact: Dr H. Preisig

S2 L1 T1

Prerequisite: CEIC2020

Basic concepts of numerical methods. Solution of single and multiple, linear and non-linear, non-differential equations. Numerical solutions of ordinary differential equations.

INDC3031

Experimental Design

Staff Contact: Dr R. Chaplin

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: A/Prof M. Brungs

S2 L2 T1

Prerequisite: CHEM2011

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: Prof M. Skyllas-Kazacos

S2 L2

Prerequisite: CHEM2011

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

S1 L2

Prerequisites: INDC2010, CHEM2011

Selected aspects of unit operations for industrial chemistry students such as distillation, liquid-liquid extraction, gas absorption, filtration evaporation and crystallization.

INDC3070

Instrumentation and Process Control 1

Staff Contact: Dr C. Dixon

S2 L2 T1

Prerequisites: MATH2021, CEIC2010, CEIC2020, CHEM2041

Analog Computation: theory and application of basic analog computing elements; magnitude and time scaling; solution of linear differential equations. Instrumentation: theory and application of transducers and transmitters for measurement of process variables. Process Dynamics: behaviour of linear, lumped parameter dynamics systems; first, second and higher order and integrating systems. Process Control: closed loop, block diagrams, controllers and controller tuning.

INDC3080**Instrumental Analysis 2***Staff Contact: Dr P. Crisp*

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*

F L1 T2

*Prerequisite: CHEM2011**Coor prerequisites 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 ethylene 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.

INDC4010**Applied Thermodynamics***Staff Contact: Dr R. Chaplin*

S1 L1 T1

Prerequisites: INDC3010, INDC3050

Calculation of thermodynamic properties for non-ideal liquid and solid solutions. Development of statistical models for real solutions of industrial importance. Thermodynamics of interfaces. Phase equilibria in binary and ternary systems. A study of chemical equilibria in multicomponents, polyphase systems including appropriate computational methods.

INDC4020**Applied Kinetics***Staff Contact: Prof D. Trimm*

S1 L1 T1

Prerequisites: INDC3020, CEIC3010

Adsorption theory, kinetics of catalytic and noncatalytic fluid-solid reactions, rates of surface reaction, kinetics of heterogeneous reactions affected by diffusion, catalyst characterization.

INDC4040**Management***Staff Contact: A/Prof M. Brungs*

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.

INDC4070**Laboratory Automation Science***Staff Contact: Dr H. Preisig*

S1 L1.5 T2.5

Prerequisite: INDC3070

The application of computers, eg 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. Organization 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*

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*

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.

INDC4100**Industrial Electrochemistry***Staff Contact: Prof M. Skyllas-Kazacos*

S1 or S2 L2

Prerequisites: INDC3090, INDC3020

Fundamentals of electrodes, the ButlerVolmer equation, current/potential laws in relationship to reaction mechanism. Electrocatalysis, gas evolution and co-deposition. Technological aspects of electrochemistry; energy conversion systems, storage systems and plating. Industrial processes, cell design and side reactions, gas bubble effect, current distribution and mass transfer effects. Developments in electrode technology, diaphragms and cell construction.

INDC4110**Water Chemistry***Staff Contact: A/Prof M. Brungs*

C3 S1 or S2 L2

Prerequisite: CEIC2010

Introduction to stability diagrams for aqueous systems. Characteristics of waters and wastewaters. Treatment of process water and boiler water. Water reclamation and wastewater treatment.

INDC4120**Chemistry of the Industrial Environment***Staff Contact: Dr P. Crisp*

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.

Centre for Minerals Engineering

MINP4010**Hydrometallurgical Processes***Staff Contact: Dr T. Tran*

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*

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*

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.

Servicing Subjects

These are subjects taught within courses offered by other faculties.

CEIC0010**Mass Transfer and Material Balances***Staff Contact: A/Prof. M. Brungs*

F L1 T1

Prerequisites: CHEM1101, CHEM1201, CIVL2505

Fundamentals of Mass Transfer: diffusion, mechanisms of mass transfer, models for mass transfer at fixed and free interfaces. Calculation of mass transfer rates at surfaces

with simple geometry. Mass transfer in dispersions. Material balances: applications of process calculations in chemical process operations, conventions in methods of analysis and measurement. The chemical equation and stoichiometry. Process calculations associated with gases, vapours and liquids. Problems involving bypass, recycle and purge. Differential material balances.

CEIC0020**Fluid/Solid Separation***Staff Contact: A/Prof. N. Foster*

SS L1.5 T.5

Particle Characterisation: Size analysis, sphericity, surface area, density. Fluid-particle Interactions: Drag coefficient, effect of Reynolds number. Terminal velocity, effect of shape, concentration. Drops and bubbles. Particle-particle interactions including flocculation. Flow through porous media. Darcy, Carmen-Kozeny, Ergun 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*

SS L3 T3

Prerequisites: CEIC0010, INDC3070 INDC4120

Selection of 3 topics from:

Environmental Pollutants

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

Pollution Control Techniques

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

Water Pollution Control Engineering

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

Air Pollution Control

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

Laboratory for Environmental Analysis

14 hour laboratory unit developing techniques in modern environmental analysis.

Advanced Environmental Protection

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

1. Advanced treatment methods (water)
2. Advanced treatment methods (air)
3. Hazardous wastes
4. Computer-aided risk assessment

- 5. Advanced laboratory
- 6. Occupational Health Laboratory

CEIC4070**Laboratory Automation for Ceramic Engineers***Staff Contact: Dr H. Presig*

S1 L1 T1

Application of microprocessors to laboratory automation. Basics of computing hardware and process interface hardware (A/D, D/A conversion, digital I/O 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.

POLY0010**Polymer Materials***Staff Contact: A/Prof. R. Burford*

S1 S2 S4

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.

Department of Fuel Technology

FUEL0010**Fuel Engineering (Mining and Mineral Processing Engineers)***Staff Contact: A/Prof. G. Sergeant*

F L2 T1

Properties and classification of fuels. Basic principles of combustion. Introduction to thermal design and configuration of furnaces, kilns, boilers, fuel using equipment. Fuel processing.

FUEL0020**Fuels and Energy***Staff Contact: A/Prof. G. Sergeant*

S2 L3 T1

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

FUEL0030**Fuel Science for Industrial Chemists***Staff Contact: A/Prof. G. Sergeant*

S1 or S2 L2

Combustion science, mechanisms of major oxidation reactions, flames, mechanism of formation of carbon, NO_x and SO_x. Measurements of gas flow, gas composition, temperature in flames and furnaces. H-t relationships and their application.

FUEL0040**Fuel Engineering for Ceramic Engineers***Staff Contact: A/Prof G. Sergeant*

F L1

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*

S1 L1 S2 L2

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

FUEL3010**Fuel and Energy Engineering 1***Staff Contact: A/Prof G. Sergeant*

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*

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*

F T6

Investigation of some aspect of fuel engineering.

Department of Polymer Science

POLY3010**Polymer Science***Staff Contact: A/Prof R. Burford*

S1 L2 S2 Lab.4

Prerequisites: CHEM2011, CHEM2021, MATH2021, MATH2819

Co or Prerequisites: INDC3090

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

Chemistry and physics of elastomers. Elements of polymer compounding and fabrication. New polymers.

POLY4010

Advanced Polymer Science

Staff Contact: A/Prof R. Burford

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 polymerization, silicon polymers and polymers for high temperature service.

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 or the Graduate Diploma.

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 specialize in the following areas:

Chemical Engineering and Industrial Chemistry Course 8015 **Fuel Technology Course 8060**

The MAppSc degree courses provide for a comprehensive study of theoretical and practical aspects of many advanced topics. The courses are formal and elective in nature and provide an opportunity for graduates to apply their basic skills in fields in which the School has developed special expertise.

The courses specializing in Chemical Engineering and Industrial Chemistry, Fuel Technology and Petroleum Engineering are 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.

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.

8015

Chemical Engineering and Industrial Chemistry Graduate Course

Master of Applied Science MAppSc

This course is designed to allow students to select areas of specialization appropriate to their needs. The areas of specialization include Industrial Chemistry, Chemical Engineering and Industrial Pollution Control. Students are asked to consult the area supervisors in the School to

develop a program of study which complies with regulations for the Master of Applied Science degree. Students may undertake a Major Project (CEIC5000) amounting to six hours per week for a year or take a Minor Project (CEIC5010) of three hours per week for a year and select an extra elective subject.

8060

Fuel Technology Graduate Course

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 specialization 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 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 organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

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

CEIC5630

Industrial Water and Wastewater Engineering

Staff Contact: Prof A.G. Fane
C3 S2 L3

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

CEIC5700

Process Principles

Staff Contact: School Office

Material and energy balances and their application in chemical combustion processes. Introduction to rate process theory. Applications of equilibria. Principles of analysis.

CEIC5810

Advanced Process Dynamics

Staff Contact: School Office

Distributed-Parameter Linear Systems: Selected distributed parameter and mathematically similar systems. Methods of analysis and features of their response. Feedback systems containing deadtime. Heat exchangers.

Distillation columns. Non-linear Systems: Selected non-linear systems, eg chemical reactors, flow systems, radiant heat transfer. Numerical solutions. Phase plane analysis. Limit cycles.

CEIC5820

Process Optimization

Staff Contact: School Office

Multivariable analytical and numerical optimization in free and constrained parameter space. Optimization of functions of a continuous variable. Dynamic programming. Applications of these techniques to specific chemical engineering problems.

CEIC5840

System Simulation and Control

Staff Contact: School Office

This is a participatory course in which case studies, discussion of recent papers, development of digital simulation programs and analog computer laboratory work play an important part.

Topics are selected from the following areas:

Unit 1 System Simulation

Numerical methods for digital simulation; programming languages and packages for system modelling of distributed parameter systems; use of analog computers in systems simulation. Application of these techniques to the study of process plant and equipment, environmental systems, and similar areas.

Unit 2 Advanced Process Control

System identification and parameter estimation; control of multiloop systems; non-linear systems; digital control and datalogging, sequencing control.

CEIC5850

Interphase Mass Transfer

Staff Contact: School Office

Advanced theories of mass transfer. The effect of interfacial instability and methods for predicting its presence.

Theoretical prediction of mass transfer in dispersed systems. Multicomponent mass transfer.

CEIC5860

Fluid Particle Interactions

Staff Contact: School Office

Fundamentals. Particle drag in an infinite laminar fluid, effect of turbulence and acceleration. Drag and rotation in shear flow. Multiparticulate systems with homo and heterogeneously sized particles. Co-current systems. Limiting particle transport velocity. Instabilities, various criteria. Transport line feed systems, transport line driers and reactor. Design of cocurrent fluid-particle systems. Gasfluidized beds. Gross behaviour, bubblephase theories, instability theories, grid-bed geometry and resistance relationships, elutriation, residence-time and sizedistribution studies. Heat and mass transfer; design of catalytic and non-catalytic fluidized reactors.

CEIC5890

Graduate Colloquia

Staff Contact: School Office

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

CEIC5910

Advanced Thermodynamics

Staff Contact: School Office

Equilibrium: liquid-liquid, liquid-solid and liquid-vapour phase equilibria for high pressure and multicomponent system; chemical reaction equilibrium for complex systems. *Molecular theory and statistical thermodynamics*: partition functions, monatomic and diatomic gases; Chapman-Enskog theory, evaluation of thermodynamic potentials and virial coefficients. *Compressible flow*: flow of compressible fluids in ducts including supersonic flow, shock waves and stagnation properties.

CEIC5920

Computeraided Design

Staff Contact: School Office

A workshop type of course with considerable time devoted to discussion, seminars, writing and running of programs. *Programming*: methods, conventions, and standards; program design, flow-charting, co-ordination and documentation. *Design*: individual plant units and components, flowsheets, optimization and economic analysis. Physical property estimation. *Simulation*: continuous change and discrete change systems.

CEIC5930

Safety in Laboratories

Staff Contact: Dr R. Chaplin

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. Ionizing and non-ionizing apparatus. Protective clothing. Precautions against hearing

loss. Chemistry and physics of flames. Fire precautions in the laboratories. Fire fighting training.

INDC5310

Catalysts and Applied Reaction Kinetics

Staff Contact: School Office

S1 or S2 L2 T4

Methods of catalyst preparation and characterization; adsorption theories; general mechanisms for gas-phase reactions catalyzed by solids; poisoning and catalyst decay; effectiveness factors; techniques in catalytic research; special topics in reaction kinetics including gas-solid non-catalytic reactions, polymer kinetics, electrochemical reaction kinetics and electrocatalysis; industrial catalytic processes; application of statistical methods to the solution of complex chemical data.

INDC5500

Instrumental Analysis for Industry

Staff Contact: School Office

F L1 T2

Role of analysis in process optimization. Accuracies of analytical methods compared to needs for equality control. Frequency of analysis in relationship to control and analytical costs. Importance of speed of analysis for information feedback. Case studies for selected processes in relation to selecting the analytical method.

INDC5610

Electrochemical Techniques for Control and Analysis

Staff Contact: School Office

S1 or S2 L2 T4

Indepth study of selected electroanalytical methods with respect to theoretical principles, instrumentation and practical utilization. The importance of adsorption and reaction mechanism on accuracies and application. Steady state and rapid scan voltammetry, stripping voltammetry, chronopotentiometry, chronocoulometry, classical coulometry and potentiometry. Instrument design and modification for specific needs.

Department of Fuel Technology

One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks.

FUEL5800

Fuel Seminar

Staff Contact: A/Prof G. Sergeant

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

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

Unit 1 - 2 (SU) Carbonization 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*

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*

Unit 1 - 1 (SU) Combustion technology.

Unit 2 - 1 (SU) Fuel impurities, removal of and deposits from.

Unit 3 - 1 (SU) Efficiency in energy utilization.

Unit 4 - 1 (SU) Combined cycles and integrated systems.

FUEL5870**Fuel Technology Practice***Staff Contact: School Office*

Compulsory in MAppSc (Fuel) (4 SU). Content bias towards choice of G subjects.

FUEL5880**Unit Operations in Wastewater, Sludge and Solid****Waste Management***Staff Contact: A/Prof G. Sergeant*

C3

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.

FUEL5881**Unit Operations in Wastewater, Sludge and Solid****Waste Management***Staff Contact: A/Prof G. Sergeant*

C3

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*

C3 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*

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.

CEIC5000**Major Project***Staff Contact: School Office*

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

CEIC5010**Minor Project***Staff Contact: School Office*

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

Department of Polymer Science

CEIC5000**Major Project***Staff Contact: School Office*

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

CEIC5010**Minor Project***Staff Contact: School Office*

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

POLY5000**Polymer Science***Staff Contact: A/Prof R. Burford*

F L3 T3

Polymer Processes: Classification of polymers, methods of polymerization; 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 polymerization, kinetics, structure effects; chain growth polymerization. Free radical polymerization, chemistry and properties of free radicals and initiators; kinetics of propagation and termination reactions; co-polymerization; monomer radical structure and reactivity. Cationic and anionic polymerization; stereoregular polymers. *Polymer Characterization:* 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.

POLY5100**Analytical Characterization of Polymers***Staff Contact: A/Prof R. Burford*

S1 or S2 L3 T3

Composition of formulated polymeric material. Group reactions, specific and colour reactions. Instrumental characterization of polymers, and co-polymers and

associated additives, eg plasticizers, anti-oxidants, etc by UV and IR spectrophotometry and pyrolysis gas chromatography. Analysis of films by transmission and reflectance spectrophotometric methods. Thermal analysis.

POLY5300

Polymer Engineering

Staff Contact: A/Prof R. Burford

S1 or S2 L4 T2

Natural and synthetic elastomers; vulcanization, theory and method. Cross-linked thermoplastics. Extrusion. Press, injection and transfer moulding. Adhesives. Heat sealing and welding. Latices. Films. Cellular polymers. Fibre reinforced plastics. Mould design. Physical testing-standards and air conditioning; basic principles; testing machines, thermal, electrical and optical properties; accelerated ageing; preparation of standard test compounds; creep; dynamic mechanical tests; rubber in

shear; abrasion; flammability. Polymer engineering applications and design data.

POLY5400

Polymer Physics

Staff Contact: A/Prof R. Burford

S1 or S2 L4 T2

Chain dimensions. Diffusion and viscosity. Segmental motion and the glass temperature T_g : factors affecting T_g . Crystallinity, thermodynamic and kinetic parameters. Viscoelastic behaviour of polymers; creep, Maxwell fluid and Kelvin-Voigt solid models, Boltzmann superposition principle; stress relaxation, relaxation and retardation time spectra, WLF curves; dynamic behaviour, elastic hysteresis, damping. Stress strain behaviour in polymers. Chemical stress relaxation in elastomeric networks. Fracture mechanisms and impact strength of polymers. Kinetic theory of rubber elasticity.

School of Fibre Science and Technology

Head of School

Professor R. E. Griffith

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.

Department of Textile Technology

Head of Department

Professor R.E. Griffith

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.

Department of Wool and Animal Science

Head of Department

Associate Professor J.P. 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 landuse 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 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 \$9,600 per annum for each of the four years of the program. 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.

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, etc.

Department of Textile Technology

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 the third year of study.

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 and surgical dressings), private consultants, government departments and authorities, teaching at secondary and tertiary levels, and pure or applied research in various organisations.

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, includes a study in depth of one of the following: chemistry, engineering or physics.

Graduates will qualify for membership of one of the following professional bodies, depending upon which option of the course is taken: the Royal Australian Chemical Institute; the Institute of Engineers, Australia; or the Australian 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	
Year 1 All Options		S1	S2
CHEM1002	Chemistry 1 or	6	6
CHEM1101	Chemistry 1A, and	6	0
CHEM1201	Chemistry 1B	0	6
TEXT1201	Introductory Textile Technology	0	4
FIBR1101	Fibre Science 1	4	0
MATH1032	Mathematics 1	6	6
PHYS1002	Physics 1, or	6	6
PHYS1022	Introductory Physics*	6	6
Totalling		22	22

*For admission into the Textile Physics or Textile Engineering options, students must complete the subject: PHYS1002-Physics 1

Textile Chemistry

		HPW	
Year 2		S1	S2
CEIC2010	Instrumental Analysis	3	3
CHEM2011	Physical Chemistry	6	0
CHEM2021	Organic Chemistry	0	6
FIBR2201	Computing Applications	4	0
TEXT2101	Fibre Science 2	0	4
TEXT2201	Textile Statistics	0	2
TEXT2301	Yarn Technology 1	6	0
TEXT2401	Fabric Technology 1	0	6
General Education Subject/s Category A		2	2
Totalling		21	23

Year 3			
CHEM3021	Organic Chemistry	6	0
Plus one of the following Chemistry electives			
CHEM2031	Inorganic Chemistry & Structure	0	6
or			
CHEM3121	Synthetic Organic Chemistry	0	6
or			
CHEM3321	Applied Organic Chemistry	0	6
or an alternative as approved by the Head of the School			
TEXT3602	Colouration Technology	0	4
TEXT3301	Yarn Technology 2	0	6
TEXT3401	Fabric Technology 2	6	0
TEXT3501	Finishing Technology A	4	0
TEXT3601	Colour Science	3	0
TEXT3101	Textile Structures 1	3	0
TEXT3801	Textile Engineering	0	3
General Education Subject/s Category B		2	2
Totalling		24	21

Textile Physics

		HPW	
Year 2		S1	S2
FIBR2201	Computing Applications	4	0
MATH2100	Vector Calculus	2.5	0
MATH2120	Mathematical Methods for Differential Equations	0	2.5
PHYS2001	Mechanics and Computational Physics	4	0
PHYS2011	Electromagnetism and Thermal Physics	0	4
PHYS2021	Quantum Physics and Relativity*	2	2
TEXT2101	Fibre Science 2	0	4
TEXT2201	Textile Statistics	0	2
TEXT2301	Yarn Technology 1	6	0
TEXT2401	Fabric Technology 1	0	6
General Education Subject/s Category A		2	2
Totalling		20.5	22.5

*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.

Year 3
PHYS2031 Laboratory* 3 3
Plus Physics electives averaging not less than 3 hours per session, selected from the following:

PHYS3021	Statistical Mechanics and Solid State Physics	4	0
PHYS3060	Advanced Optics	0	2
PHYS3110	Experimental Physics B1	4	0
PHYS3120	Experimental Physics B2	0	4
PHYS3410	Biophysics	3	0
PHYS3710	Advanced Laser and Optical Applications	2	0

or an alternative as approved by the Head of the School

TEXT3101	Textile Structures 1	3	0
TEXT3301	Yarn Technology 2	0	6
TEXT3401	Fabric Technology 2	6	0
TEXT3501	Finishing Technology A	4	0
TEXT3601	Colour Science	3	0
TEXT3602	Colouration Technology	0	4
TEXT3801	Textile Engineering	0	3
General Education Subjects/s Category B		2	2
Totalling		24	21

* See note for Year 2

Textile Engineering

		HPW	
Year 2		S1	S2
CIVL0616	Structures	3	0
ELEC0802	Electrical Power Engineering	0	3
ELEC0805	Electronics for Measurement and Control	3	0
FIBR2201	Computing Applications	4	0
MATH2021	Mathematics	2	2
MECH1110	Graphical Analysis and Communication	0	3
MECH1300	Engineering Mechanics 1	4	0
TEXT2101	Fibre Science 2	0	4
TEXT2201	Textile Statistics	0	2
TEXT2301	Yarn Technology 1	6	0
TEXT2401	Fabric Technology 1	0	6
General Education Subject/s Category A		2	2
Totalling		24	22
Year 3			
MECH2300	Engineering Mechanics 2A	3	0
MECH2310	Engineering Mechanics 2B	0	3
MECH2600	Fluid Mechanics 1	2	2
MECH2700	Thermodynamics 1	2	2
TEXT3101	Textile Structures 1	3	0
TEXT3301	Yarn Technology 2	0	6
TEXT3401	Fabric Technology 2	6	0
TEXT3501	Finishing Technology A	4	0
TEXT3601	Colour Science	3	0
TEXT3602	Colouration Technology	0	4
General Education Subject/s Category B		0	4
Totalling		23	21
Year 4 (All Options)			
TEXT4202	Textile Quality Control	0	2
TEXT4701	Textile Industry Studies†	3	0
TEXT4003	Project	5	9
TEXT4013	Seminar	2	2
TEXT4101	Textile Structures 2	0	3
TEXT4201	Processing Laboratory	3	0
TEXT4501	Finishing Technology B	0	4
MANF4420	Management of Manufacturing Systems, or	6	0
TEXT4702	Textile Management*	6	0
APSE0002	Social Issues in Applied Science	2	0
Totalling		21	20

* Coop Program students only.

†These subjects contribute towards satisfaction of the Category C General Education requirement.

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	
Year 1		S1	S2
CHEM1101	Chemistry 1A, or	6	0
CHEM1401	Introductory Chemistry A	6	0
ECON1101	Microeconomics 1, or	3.5	0
ECON1103	Microeconomic Principles*	3.5	0
ECON1102	Macroeconomics 1, or	0	3.5
ECON1104	Macroeconomic Principles*	0	3.5
FIBR1101	Fibre Science 1	4	0
MATH1032	Mathematics 1, or	6	6
MATH1011	General Mathematics 1B and	6	0
MATH1021	General Mathematics 1C	0	6
PHYS1939	Physics	0	4
TEXT1101	Science for Textiles	0	2
TEXT1201	Introductory Textile Technology	0	4
Totalling		19.5	19.5

* Graded level passes in these subjects are necessary to satisfy prerequisites for subjects ECON2103 and ECON2104.

Year 2			
ACCT1501	Accounting and Financial Management 1A	4.5	0
ACCT1511	Accounting and Financial Management 1B	0	4.5
FIBR2201	Computing Applications	4	0
MARK2012	Marketing Systems	4	0
MARK2052	Marketing Research	0	4
TEXT2101	Fibre Science 2	0	4
TEXT2201	Textile Statistics	0	2
TEXT2301	Yarn Technology 1	6	0
TEXT2401	Fabric Technology 1	0	6
General Education Subject/s Category A		2	2
Totalling		20.5	22.5

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

		HPW	
Year 3		S1	S2
TEXT3101	Textile Structures 1	3	0
TEXT3301	Yarn Technology 2	0	6
TEXT3401	Fabric Technology 2	6	0
TEXT3501	Finishing Technology A	4	0
TEXT3601	Colour Science	3	0
TEXT3801	Textile Engineering	0	3
TEXT3602	Colouration Technology	0	4
Plus 2 Commerce electives selected from the following:			
ACCT2522	Accounting and Financial Management 2A	4.5	or 4.5
ACCT2542	Accounting and Financial Management 2B	4.5	or 4.5
ECOH2301	Management and Business Development	3	0
ECON2103	Applied Microeconomics	3.5	or 3.5
ECON2104	Applied Macroeconomics	3.5	or 3.5
FINS2613	Business Finance 2A	3	or 3
INFS1602	Computer Information Systems 1	3	or 3
INFS2603	Computer Information Systems 2	3	
IROB1701	Industrial Relations 1A	3.5	or 3.5
LEGT7711	Legal Environment of Commerce	3	or 3
LEGT7731	Legal Regulation of Marketing and Distribution	3	or 3
MARK3073	Brand Management	4	0
MARK3083	Strategic Marketing Management	0	4
or an alternative as approved by the Head of the School			
General Education Subject/s Category B		0	4
Totalling		19	20
Year 4			
MANF4420	Management of Manufacturing Systems, or	6	0
TEXT4702	Textile Management*	6	0
TEXT4701	Textile Industry Studies†	3	0
TEXT4003	Project	5	9
TEXT4013	Seminar	2	2
TEXT4101	Textile Structures 2	0	3
TEXT4201	Processing Laboratory	3	0
TEXT4202	Textile Quality Control	0	2
TEXT4501	Finishing Technology B	0	4
APSE0002	Social Issues in Applied Science†	2	0
Totalling		21	20

*Coop Program students only

†These subjects contribute to satisfaction of the Category C General Education Requirement.

application of principles which are relevant to all aspects of pastoral production, including production and utilization 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, range land 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.

Department of Wool and Animal Science

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

3220**Wool and Pastoral Sciences - Full-time Course****Bachelor of Science****BSc**

		HPW	
		S1	S2
Year 1			
BIOS1011	Biology A	6	0
BIOS1021	Biology B	0	6
CHEM1002	Chemistry 1	6	6
FIBR1001	Natural Fibre Production	0	6
FIBR1101	Fibre Science 1	4	0
MATH1032	Mathematics 1 or	6	6
MATH1011	General Mathematics 1B and	6	0
MATH1021	General Mathematics 1C	0	6
Totalling		22	24

Year 2			
CHEM2929	Agricultural and Biological Chemistry	6	0
FIBR2201	Computing Applications	4	0
WOOL2103	Livestock Production 1	2	2
WOOL2203	Agronomy	3	6
WOOL2303	Agricultural Economics and Management	3	3
WOOL2503	Wool Science 1	3	3
WOOL2601	Animal Physiology 1	0	6
MATH2819	Statistics SA	2	2
General Education Subject/s Category A		2	2
Totalling		25	24

Year 3			
WOOL3203	Pastoral Agronomy	4	4
WOOL3401	Animal Nutrition	0	4
WOOL3503	Wool Science 2	3	3
WOOL3701	Animal Health and Welfare	3	0
WOOL3803	Genetics 1	3	3
WOOL3901	Biostatistics 1	4	0
BIOC2312	Principles of Biochemistry and Molecular Biology	6	6
General Education Subject/s Category B		2	2
Totalling		25	22

		HPW	
		S1	S2
Plus one of the three available options			
WOOL3111	Livestock Production 2	0	3
WOOL3211	Crop Agronomy*	0	3
WOOL3221	Range Management*	0	3
WOOL3511	Wool Marketing	0	3
Totalling			25

*Available in alternate years

Year 4			
APSE0002	Social Issues in Applied Science†	2	0
WOOL4003	Project	6	6
WOOL4013	Seminar	2	2

†This subject contributes towards satisfaction of the Category C General Education requirement.

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

Optional subjects

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

Some subjects may not be offered in all years.

*Available in alternate years.

Group B			
BIOS3061	Plant Ecosystem Processes	6	0
GEOG2021	Introduction to Remote Sensing	0	4
GEOG3032	Remote Sensing Applications	4	0
MARK2012	Marketing Fundamentals	4	0
MARK2052	Marketing Research	0	4
MICR2201	Introductory Microbiology	6	0

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

Subject Descriptions

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

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 School.

APSE0002**Social Issues in Applied Science**

Staff Contact: Dr Jean Cross

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.

School of Fibre Science and Technology

FIBR1001

Natural Fibre Production

Staff Contact: A/Prof David Cottle
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
S1 L2 T2

Fibre classification and raw materials. World production and consumption of textile fibres. Necessary and desirable attributes of textile fibres. Production of natural and man-made fibres. Introduction to fibre morphology and fibre structure. Practical fibre identification.

FIBR2201

Computing Applications

Staff Contact: A/Prof John James
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.

Department of Textile Technology

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

TEXT1101

Science for Textiles

Staff Contact: A/Prof Michael Pailthorpe
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
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
S2 L2 T2

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. Moisture sorption and swelling. Addition and condensation polymerisation. Chemical constitution and reactivity of man-made fibres. Introduction to high technology fibres.

TEXT2201

Textile Statistics

Staff Contact: Dr Xungai Wang
S2 L2

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

TEXT2301

Yarn Technology 1

Staff Contact: Dr Xungai Wang
S1 L3 T3

The preparation of staple fibres for yarns and nonwoven 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
S2 L3.5 T2.5

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. Introduction to knitting technology.

TEXT3101

Textile Structures 1

Staff Contact: Prof Ron Postle
S1 L1 T2

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 tailor ability.

TEXT3301**Yarn Technology 2**

Staff Contact: Dr Xungai Wang
S2 L3 T3

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
S1 L3.5 T2.5

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 knitting. Mechanics of knitted fabric formation. Stitch-bonded and non-woven fabric manufacture.

TEXT3501**Finishing Technology A**

Staff Contact: Dr Shantha David
S1 L2 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, detergency.

TEXT3601**Colour Science**

Staff Contact: A/Prof Mike Pailthorpe
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: A/Prof Mike Pailthorpe
S2 L2 T2

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 printing methods. Textile dyeing machinery. Textile printing methods. Recent developments in dyeing and printing technology.

TEXT3801**Textile Engineering**

Staff Contact: Prof Ross Griffith
S2 L2 T1

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: A/Prof Michael Pailthorpe
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: A/Prof Michael Pailthorpe
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
S2 L1 T2

Structural mechanics of woven, knitted and non-woven fabrics. Composite materials, fabric membrane properties. Clothing mechanics. Fabric rheology. Physical equilibration processes. Wrinkling properties. Clothing comfort and physiology. Thermal insulation. Diffusion of moisture. Heat and mass transfer. Capillary action of textiles.

TEXT4201**Processing Laboratory**

Staff Contact: Dr John Curiskis
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: A/Prof Mike Pailthorpe
S2 L2

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

TEXT4501**Finishing Technology B**

Staff Contact: Dr Shantha David
S2 L2 T2

The production of specified dimensions in textile fabrics; heat, chemical and mechanical processes, surface

finishes, protective finishes. The application of special finishes including flame-proof finishes, crease-resistant finishes, etc. Dimensional stability and its measurement. Recent developments in finishing technology.

TEXT4701

Textile Industry Studies

Staff Contact: Prof Ross Griffith

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. Recent developments in fabric forming technology. Environmental considerations in relation to pollution from the textile industry. Waste water treatment methods. The employment function of the textile and clothing industries. Social and political consequences of automation: polarisation of workforce into highly-skilled and unskilled workers; conflict between maintaining a viable industry and maintaining employment levels.

TEXT4702

Textile Management

Staff Contact: Prof Ross Griffith

S1 T6

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

Department of Wool and Animal Science

WOOL2103

Livestock Production 1

Staff Contact: A/Prof John Kennedy

C6 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

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

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

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

S2 L3 T3

Prerequisite: BIOS1021

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 gastrointestinal tract and of the kidney. Heat tolerance and climatic adaptation.

WOOL3111

Livestock Production 2

Staff Contact: Dr Doug Murray

C3 S2 L2 T1

Prerequisite: WOOL2103

The scope for intensification of ruminant production. The behaviour, nutrition, environmental physiology and health of intensively managed animals. Housing and environmental control of facilities. Examples of intensification, e.g. feed lots, sea transport.

WOOL3203

Pastoral Agronomy

Staff Contact: Dr Gordon King

C6 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

S2 L2 T1

Prerequisite: WOOL2203

Note/s: Available in alternate years. Not available in 1994.

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

WOOL3221**Range Management***Staff Contact: Dr Gordon King*

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 semiarid environments. Administration of rangelands (eg 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*

S2 L3 T1

Composition and classification of foodstuffs and pastures. Physiology of ruminant digestion. Digestion absorption and metabolism of carbohydrates, proteins, fats, mineral and vitamins. Digestibility of foodstuffs. Nutrient and energy balances and requirements of livestock. Feeding standards and the quantitative application of nutritional data with particular reference to Australian conditions. Utilisation of forage by grazing ruminants. 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*

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*

S2 L2 T1

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

WOOL3701**Animal Health and Welfare 1***Staff Contact: A/Prof John Kennedy*

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*

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*

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*

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*

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*

C6 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*

S1 L2 T2

Prerequisite: WOOL3401

Utilization of metabolizable energy: protein digestion and utilization; 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, Sharnlea wool production, milk production.

WOOL4513

Wool Science 3

Staff Contact: A/Prof David Cottle

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

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

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.

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 or Doctor of Philosophy.

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	S2
TEXT5001	Textile Technology Dissertation	1.5	1.5
TEXT5003	Textile Technology	1.5	1.5
TEXT5101	Fibre Science A	6	0
TEXT5102	Fibre Science B	4	0
TEXT5201	Textile Quality Control	2	0
Plus two electives per session (averaging not less than 9 hours per session), selected from the following:			
TEXT5301	Yarn Technology A	5	0
TEXT5302	Yarn Technology B	0	5
TEXT5401	Fabric Technology A	0	5
TEXT5402	Fabric Technology B	5	0
TEXT5501	Finishing Technology A	5	0
TEXT5502	Finishing Technology B	0	5
TEXT5601	Colour Science	4	0
TEXT5602	Dyeing Technology	0	4
or an alternative as approved by the Head of School			
Totalling		18	18

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

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 or Doctor of Philosophy.

5081 Wool and Pastoral Sciences Graduate Diploma Course

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 School.

Full-time Course

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

	HPW
WOOL5113 Livestock Production	6
WOOL5213 Range Management	4
WOOL5513 Wool Science	6
WOOL5813 Animal Breeding	4
WOOL5913 Quantitative Methods	4

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

Programs are available leading to the award of Graduate Diploma in Rangeland Management (Course 5025) in the following areas of study:

Range Management

For course details see Graduate Study in the School of Geography section.

Subject Descriptions

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

Department of Textile Technology

TEXT5001

Textile Technology Dissertation

Staff Contact: A/Prof Michael Pailthorpe

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

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: A/Prof John Kennedy

S1 L4 T2

Fibre classification and raw materials. Necessary and desirable attributes of textile fibres. Production of natural and man-made fibres. Physics and chemistry of natural and man-made fibres. Introduction to fibre morphology and fibre structure. Introductory statistics and sampling theory. Basic techniques for the measurement of fibre properties. Fibre transverse dimensions and length. Practical fibre identification. World production and consumption of textile fibres.

TEXT5102

Fibre Science B

Staff Contact: Dr Shantha David

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 polymerisation. Chemical constitution and reactivity of man-made fibres. Introduction to high technology fibres.

TEXT5201

Textile Quality Control

Staff Contact: A/Prof Mike Pailthorpe

S2 L T2

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

TEXT5301

Yarn Technology A

Staff Contact: Dr Xungai Wang

S1 L3 T2

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

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
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
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
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, detergency.

TEXT5502**Finishing Technology B**

Staff Contact: Dr Shantha David
S2 L2 T3

The production of specified dimensions in textile fabrics; heat, chemical and mechanical processes, surface finishes, protective finishes. The application of special finishes including flame-proof finishes, crease-resistant finishes, etc. Dimensional stability and its measurement. Recent developments in finishing technology.

TEXT5601**Colour Science**

Staff Contact: A/Prof Mike Pailthorpe
S1 L2 T2

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: A/Prof Mike Pailthorpe
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.

Department of Wool and Animal Science

WOOL5113**Livestock Production**

Staff Contact: A/Prof J P Kennedy
C12 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
C3 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
C9 F T9

A theoretical and or experimental investigation of some aspect of management of rangelands.

WOOL5513**Wool Science**

Staff Contact: A/Prof David Cottle
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***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.

WOOL5913**Quantitative Methods***Staff Contact: A/Prof John James***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 J. R. Dodson

Administrative Assistant

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.

General Education Electives

For details of the General Education requirements see Faculty Information.

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 wellbeing. These courses provide elective specializations 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 **8024**; Masters' and Diploma courses in Remote Sensing **8026** and **8056**, or Masters' and Diploma courses in Rangeland Management **8025** and **5025**, Masters' in Environmental Management **8046** 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

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 specializations 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 specialization 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 organizations concerned with the investigation and planned use of resources et cetera.

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.

3010.1000/2000/3000

Applied Geography - Full-time Course

Bachelor of Science BSc

Applied Physical Geography, Applied Economic Geography and Human and Physical Resources

		HPW	
Year 1 All Strands		S1	S2
GEOG1000	Field Project 1	2	2
GEOG1043	Data Processing Systems	4	0
GEOG1044	Data Display Systems	0	4
GEOG1051	Global Environmental Problems and Processes	3	0
GEOG1062	Australia and Global Development	0	3
MATH1011	General Mathematics 1B and	6	0
MATH1021	General Mathematics 1C or	0	6
MATH1032	Mathematics 1 or	6	6
MATH1042	Higher Mathematics 1	6	6
and either			
BIOS1011	Biology A and	6	0
BIOS1021	Biology B and	0	6
GEOG1031	Environmental Processes or	0	4
GEOG1031	Environmental Processes and	0	4
GEOG1101	Geological Processes and	6	0
GEOG1201	Geological Environments or	0	6
GEOG1022	Locational Processes	0	4
and either			
ECON1101	Microeconomics 1 and	3.5	0
ECON1102	Macroeconomics 1 or	0	3.5
* ECON1103	Microeconomic Principles and	3.5	0
* ECON1104	Macroeconomic Principles	0	3.5
Totalling		18.5/	18.5/
		21	21

* Note: Credit necessary to take ECON2203 and ECON2204

Applied Physical Geography (3010.1000)

Year 2			
GEOG2000	Field Project 2	1.5	1.5
GEOG2013	Geographic Data Analysis	4	0
GEOG2021	Introduction to Remote Sensing	0	4
GEOG3021	Biogeography	4	0
GEOG3051	Soils and Landforms	4	0
GEOG3122	Geographic Information Systems	0	4
GEOG3211	Australian Environments and Natural Resources	0	4
and either			
GEOL2011	Mineralogy and Igneous Petrology	6	0
and			
GEOL2022	Petrology and Structural Geology	0	6
or any two of the following			
BIOS2021	Introductory Genetics	0	6
BIOS2031	Biology of Invertebrates	0	6
BIOS2051	Flowering Plants	0	6
BIOS2061	Vertebrate Zoology	6	0
and for all students			
General Education Subject/s (Category A)		2	2
Totalling		21.5	21.5

		HPW	
		S1	S2
Year 3			
GEOG2032	Geomorphology	0	4
GEOG3000	Field Project 3	1.5	1.5
GEOG3011	Pedology	0	4
GEOG3032	Remote Sensing Applications	4	0
GEOG3062	Environmental Change	0	4
GEOG3082	Project Design and Formulation	0	3
GEOG3142	Geographic Information Systems Applications	4	0
and one of the following			
CHEM1101	Chemistry A	6	0
CHEM1401	Introductory Chemistry A	6	0
BIOS3061	Plant Ecosystem Processes	6	0
GEOL7321	Geology for Geomorphologists and Pedologists	2	4
and for all students			
General Education Subject/s (Category B)		2	2
Totalling		13.5	22.5
		/17.5	/18.5

Applied Economic Geography (3010.2000)

Year 2			
ECON2103	Applied Microeconomics	0	3.5
ECON2104	Applied Macroeconomics	3.5	0
GEOG2000	Field Project 2	1.5	1.5
GEOG2013	Geographical Data Analysis	4	0
GEOG2052	Project in Spatial Analysis	0	4
GEOG2061	Regional Theory	4	0
GEOG2071	Transport and Land Use	0	4
GEOG2092	Australian Social and Economic Landscapes	3	0
GEOG3122	Geographic Information Systems	0	4
and General Education Subject/s (Category A)		2	2
Totalling		22	19
Year 3			
GEOG2041	Mathematical Methods for Spatial Analysis	4	0
GEOG3000	Field Project 3	1.5	1.5
GEOG3082	Project Design and Formulation	0	3
GEOG3101	Sample Surveys and Questionnaire Design	4	0
GEOG3172	Spatial Population Analysis	0	4
GEOG3132	Marketing Geography	4	0
plus two of the following			
GEOG2021	Introduction to Remote Sensing	0	4
GEOG3142	Geographic Information Systems Applications	4	0
GEOG3152	Social Welfare and Urban Development	4	0
GEOG3192	Urban and Regional Development	0	4
GEOG3181	Urban Activity Systems	4	0
GEOG3333	Special Topic	2	2
GEOG3334	Special Research Methods	2	2
plus two of the following (one each session):			

		HPW	
		S1	S2
ECON2108	Industry Economics and Australian Industrial Policy	0	3
ECON2109	Economics of Natural Resources	3	0
ECON2117	Economics of Tourism	3	0
ECON2127	Environmental Resources and Cost Benefit Analysis	0	3
ECON3115	Economics of Developing Countries	3	0
and General Education Subject/s (Category B)		2	2
Totalling		15	18.5
		/23	/10.5

*One subject may be substituted for those listed with permission of Head of School.

Human and Physical Resources (3010.3000)

Year 2			
GEOG2092	Australian Social and Economic Landscapes	3	0
GEOG2000	Field Project 2	1.5	1.5
GEOG2013	Geographical Data Analysis	4	0
GEOG3122	Geographic Information Systems	0	4
GEOG3021	Biogeography	4	0
GEOG3051	Soils and Landforms or	4	0
GEOG2061	Regional Theory	4	0
and either			
ECON2103	Applied Microeconomics and	0	3.5
ECON2104	Applied Macroeconomics and	3.5	0
GEOG2052	Project in Spatial Analysis or	0	4
GEOL2011	Mineralogy and Igneous Petrology	6	0
and			
GEOL2022	Petrology and Structural Geology	0	6
or two of			
BIOS2031	Biology of Invertebrates	0	6
BIOS2051	Flowering Plants	0	6
BIOS2061	Vertebrate Zoology	6	0
and			
General Education Subject/s (Category A)		2	2
Totalling		22	16
		/22.5	/17.5

		HPW	
Year 3		S1	S2
GEOG2021	Introduction to Remote Sensing	0	4
GEOG3000	Field Project 3	1.5	1.5
GEOG3062	Environmental Change	0	4
GEOG3082	Project Design and Formulation	0	3
GEOG3172	Spatial Population Analysis	4	0
plus two of the following			
GEOG2032	Geomorphology	0	4
GEOG3011	Pedology	0	4
GEOG3032	Remote Sensing Applications	4	0
GEOG3132	Marketing Geography	0	4
GEOG3142	Geographic Information Systems		
	Applications	4	0
GEOG3152	Social Welfare and Urban		
	Development	4	0
and either two of the following			
ECON2109	Economics of Natural Resources	3	0
ECON2117	Economics of Tourism	3	0
ECON2127	Environmental Resources and		
	Cost Benefit Analysis or	0	3
one of the following			
GEOL7321	Geology for Geomorphologists		
	and Pedologists	2	4
BIOS3061	Plant Ecosystem Processes	6	0
and for all students			
General Education Subject/s (Category B)		2	2
Totalling		17.5	17.5
		/19.5	/22.5

Applied Physical Geography, Applied Economic Geography and Human and Physical Resources.

		HPW	
Year 4 All Strands		S1	S2
GEOG3042	Environmental Impact		
	Assessment	0	4
GEOG4010	Field Project 4	0	8
GEOG4031	Project	16	0
GEOG4042	Practical Applications†	3	0
GEOG4052	Advanced Spatial Analysis*	0	4
GEOG4062	Advanced Environmental		
	Analysis*	0	4
Totalling		19	20

*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.

†This subject contributes towards satisfaction of the Category C General Education requirement.

Note: Students will incur personal costs in connection with project work in the final year of study.

Subject Descriptions

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

GEOG1000

Field Project 1

Staff Contact: Drs B. Parolin, I. Prosser
S1 T4

A five days field project normally undertaken during the midyear recess, designed to support teaching in Year 1 Level 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
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: A/Prof M. Fox, A/Prof M. Melville & Mr A. Evans

S2 L2 T2

Note/s: Excluded GENS4240.

Essential and continuing links between components of the physical environment. Movement of energy and matter in the physical environment, including consideration of Earth's energy balance, the hydrological cycle, nutrient cycles in vegetation and soil, imbalances leading to land degradation and instability, and to movement of materials.

GEOG1043

Data Processing Systems

Staff Contact: Mr S. Filan
S1 L2 T2

Measurement, management, analysis and display of general and spatial data. Basic use of VAX computers; operating systems and file management. EDT editor. Use of software (SPSS*) for management, processing, analysis and display of data.

GEOG1044

Data Display Systems

Staff Contact: Prof B. Garner
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 GIMMS software.

GEOG1051

Global Environmental Problems and Processes

Staff Contact: Dr I. Prosser

S1 L2 T1

The subject outlines the principles and processes necessary to appreciate the physical background behind major global-scale environmental problems. Principles and processes include the linkages between the lithosphere, hydrosphere and biosphere, atmospheric circulation, energy and radiation balance and ecosystem function. Problems covered are the issues of desertification, deforestation, 'greenhouse', ozone depletion, energy conservation and pollution.

GEOG1062

Australia and Global Development

Staff Contact: A/Prof I. Burnley, Drs M. Sant, P. Simons

S2 L2 T1

The main concern is the progressive integration of Australia into global capitalism and the developmental and environmental consequences of this process in Australia and Pacific Rim countries and adjacent territories. Topics covered include colonial and dependent development in Australia and resource use; applications of 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 relationship between changing trade patterns, production and development in Australia and Pacific Rim countries; Australia in a future world.

GEOG2000

Field Project 2

*Staff Contact: A/Prof J. Dodson & A/Prof M. Fox (Physical)
Dr M. Sant & Mr S. Filan (Economic)*

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: A/Prof J. Dodson

S1 L1 T3

Prerequisite: Both GEOG1051 and either GEOG1031 or GEOG1062

Note/s: Excluded GEOG2093.

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

S2 L2 T2

Prerequisite: Successful completion of a Year 1 program in Applied Science, Science or Arts or equivalent as approved by the Head of School

Principles and technical aspects of remote sensing. Forms of available imagery, their utility and facilities for interpretation. Basic airphoto interpretation techniques relevant to environmental assessment. Introduction to principles of the electromagnetic spectrum, photometry and radiometry. Sensor types, image formation and end products associated with selected satellite programs, including Landsat. Land-cover and land-use interpretation procedures in visual image analysis. Basic procedures in machine-assisted image enhancement.

GEOG2032

Geomorphology

Staff Contact: Drs W. Erskine, I. Prosser

S2 L2 T2

Prerequisites: GEOG3051

Drainage basin processes including: weathering, the production of runoff and sediment, sediment tracing, sediment budgets and denudation histories. The processes of river channel 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.

GEOG2041

Mathematical Methods for Spatial Analysis

Staff Contact: Mr S. Filan

S1 L2 T2

Prerequisite: MATH1011 and MATH1021 or MATH1032 or MATH1042 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.

GEOG2052

Project in Spatial Analysis

Staff Contact: Dr M. Sant & Mr S. Filan

S2 L1 T3

Prerequisite: GEOG2041

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

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

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 & Dr P. Simons

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.

GEOG2093

Geographic Methods

Staff Contact: Dr S. Walker

S2 L2 T2

Prerequisites: Both GEOG1051 and either GEOG1031 or GEOG1062

Note/s: Excluded GEOG2013.

Statistical procedures and field methods used in both human and physical geography. Includes: measures of dispersion; measures of spatial distribution; samples and estimates; correlation and regression; tests for distribution in space; data collection and analysis; field observations. Three days field work is a compulsory part of the subject and students will incur some personal expenses with this.

GEOG3000

Field Project 3

Staff Contact: A/Prof M. Melville (Physical),

Prof B. Garner & Dr B. Parolin (Economic)

F T1.5

Prerequisite: One of GEOG3011, GEOG3021, GEOG2032. 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

S1 L2 T2

Prerequisites: GEOG1031 or GEOG1051 and one of CHEM1101 or CHEM1401 or both GEOL1101 and GEOL1201 or both BIOS1011 or BIOS1021

Methodology of pedogenic studies and the application of these studies to the understanding of soil/landform relationships. Soil physical and chemical properties and their interrelationships, emphasizing clay/mineral structure and behaviour, soil solution chemistry, soil water movement and the application of these properties to elements of soil mechanics. Soil properties in natural, rural and urban landscapes, including assessment of soil fertility, swelling characteristics, dispersibility, erodibility and aggregate stability. Laboratory analysis of soil physical and chemical characteristics with emphasis on properties associated with land capability assessment. Statistical analysis of soil data and its application to mapping. The use of soil micromorphological and mineralogical studies in pedology.

GEOG3021

Biogeography

Staff Contact: A/Prof J. Dodson & A/Prof M. Fox

S2 L2 T2

Prerequisites: GEOG1031 or GEOG1051 or both BIOS1011 and BIOS1021

Distribution of taxa. Floras of the Southern Hemisphere with particular reference to Australia. Endemic, discontinuous and relict taxa. Dispersal and migration of species. Origin, evolution and geological history of Angiosperms. The development of the Australian biogeographic element. Study of the recent past to understand present distributions of taxa. The role of humans and climatic change on Australian vegetation. Detection of pattern and association and their causes. Classification, ordination and mapping of vegetation. Ecology of selected Australian vegetation types. Management of vegetation in different climate regimes.

GEOG3032

Remote Sensing Applications

Staff Contact: Mr A. Evans

S1 L2 T2

Prerequisite: GEOG2021 or SURV8711

Spectral characteristics of natural phenomena and image formation. Ground truthing, collection and calibration. Introduction to computer classification procedures. Multitemporal sampling procedures, image to image registration and map to image registration. Major applications of remote sensing in the investigation of renewable and non-renewable resources to include: soils, geology, hydrology, vegetation, agriculture, rangelands, urban analysis, regional planning, transportation and route location and hazard monitoring.

GEOG3042

Environmental Impact Assessment

Staff Contact: Prof B. Garner & Dr W. Erskine

S2 L2 T2

Prerequisites: GEOG1031 or GEOG1051 or by permission from Head of School

Rationale and basic objectives; history and legislative framework; standardized types of environmental impact

assessment EIA, including matrix approach, adopted methods of EIA in Australia. Techniques of impact evaluation in terms of socio-economic criteria. Environmental decision making and planning under conditions of uncertainty. Case studies exemplifying procedures, techniques and issues. Trends, changes and possible future developments in EIA. Practical exercises representing components of typical EIAs.

GEOG3051

Soils and Landforms

Staff Contact: Drs W. Erskine, I. Prosser

S1 L2 T2

Prerequisite: GEOG1031 or GEOG1051

An introduction to soil classification schemes with particular emphasis on the soils and landforms of floodplains and the 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.

GEOG3062

Environmental Change

Staff Contact: A/Prof J. Dodson

S2 L2 T2

Prerequisite: Successful completion of a Year 2 Programme in Applied Science, Science, or Arts or equivalent as approved by the Head of School

The nature of environmental change on the land, oceans, biosphere and atmosphere. Evolution of the continents, oceans, life and atmosphere. Techniques for environmental reconstruction and chronology building. Quaternary climatic change and modelling. Human impact on the atmosphere and climatic consequences.

GEOG3082

Project Design and Formulation

Staff Contact: Dr P. Simons

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: Drs P. Simons & B. Parolin

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 B.J. Garner & Mr S. Filan

S2 L2 T2

Prerequisite: GEOG3161 or by permission from the Head of School This prerequisite does not apply to students enrolled in course 3010.

An introduction to information systems of particular relevance 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: Dr P. Simons

S2 L2 T2

Prerequisite: MARK2042 This prerequisite does not apply to students enrolled in course 3010

Organization and operation of the marketing function and trends in its performance. 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 intraurban 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

S1 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: Dr S. Walker (A/Prof I. Burnley)

S1 L2 T2

Prerequisite: GEOG2092 or GEOG3202. This prerequisite does not apply to students enrolled in course 3010

A consideration of 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 B.J. Garner

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 GIMMS 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*

S2 L2 T2

Prerequisite: GEOG3202

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*

S1 L2 T2

Prerequisite: GEOG3202

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*

S2 L2 T2

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 and Dr I. Prosser*

S2 L2 T2

Prerequisite: GEOG1051 or GEOG1031

The characteristics of Australia's physical and biotic environment: geology, climate, geomorphology, soils, vegetation and fauna. The problems of exploiting Australia's water and land resources including the degradation of land by erosion, salinisation and soil fertility decline; and habitat loss and fragmentation.

GEOG3221**Advanced Geographic Methods***Staff Contact: Dr S. Walker*

S1 L2 T2

Prerequisites: GEOG2093*Note/s:* Excluded GEOG2013.

Additional quantitative research techniques normally taken by Honours students in their third year. Research organization; computer analysis; collection and organization of data; statistical description; hypothesis testing and sampling; simple and multiple association analysis; nonparametric methods.

GEOG3333**Special Topic***Staff Contact: School Office*

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/Professor I. Burnley*

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*

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: School Office*

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.

GEOG4100/GEOG4050**Honours Geography***Staff Contact: A/Prof I. Burnley (Arts) &**Mr A. Evans (Science)*

F

Prerequisites: Arts students must satisfy Faculty requirements for entry to the Honours Level program and must have obtained at least 54 credit points in Geography subjects, including 12 Level 1 credit points. A minimum cumulative average at Credit level is required for all Upper Level subjects taken which must include GEOG3221.

Details of Honours Geography for science students are available from the School of Geography office

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.

GEOG4042**Practical Applications in Geography***Staff Contact: Dr P. Simons*

S1 T3

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.

GEOG4052

Advanced Spatial Analysis

Staff Contact: Dr S. Walker

S2 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

S2 L2 T2

Selected topics in the study of human and physical environments, chosen to illustrate contemporary frontiers of research and development in environmental studies.

Graduate Study

Course Outlines

8024

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, Surveying, or a relevant environmental science.

Course requirements. Candidates are required to complete a course totalling 30 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

GEOG9240	Principles of Geographic Information Systems	C 3
and either GEOG9241	Advanced Geographic Information Systems	3
or SURV9604	Land Information Systems	3
and one of the following GEOG9280	Applications and Management of GIS*	3
or GEOG9330	Spatial Data/Processing and Integration*	3
and either GEOG9509	Project	9
or GEOG9512	Project	12

Elective Subjects

COMP9311	Data Base Systems	3
GEOG9210	Computer Mapping and Data Display	3
GEOG9150	Remote Sensing Applications	3
SURV9532	Data Acquisition and Terrain Modelling	3
SURV9608	Cadastral Systems	3
GEOG9250	Special Topic	3
GEOG9290	Image Analysis in Remote Sensing	3
SURV9600	Principles of Remote Sensing	3
SURV9602	Remote Sensing Procedures	3

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

General

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 30 credits for the Masters degree or 24 credits 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 9 credit 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 Graduate Course**

**Master of Applied Science
MAppSc**

Compulsory Subjects

WOOL5213	Range Management	C 3
GEOG9320	Soil degradation and Conservation	3
GEOG9509	Project or	3
WOOL5223	Project	9

Optional Subjects

Choose subjects totalling 15 credits from the following list:

BIOS3014	Ecological Studies in Arid Lands Management	3
CIVL9842	Groundwater Hydrology	3
CIVL9875	Hydrological Processes	3
ECON2109	Economics of Natural Resources	3
GEOG9150	Remote Sensing Applications	3
GEOG9240	Principles of Geographic Information Systems	3
GEOG9310	River Management	3
GEOG9130	Soil Studies for Arid Lands Management	3
GEOG9300	Vegetation Management	3
WOOL5113	Livestock Production	12

Additional subjects may be substituted with the permission of the Course Coordinator.

5025**Rangeland Management Graduate Diploma Course**

**Graduate Diploma
GradDip**

Compulsory Subjects

GEOG9320	Soil Degradation and Conservation	C 3
WOOL5213	Range Management	3

Optional Subjects

Choose subjects totalling 18 credits, to include at least 9 credits of graduate level subjects.

CIVIL9842	Groundwater Hydrology	C 3
CIVIL9875	Hydrological Processes	3
WOOL2103	Livestock Production 1*	6
WOOL3111	Livestock Production 2*	3
WOOL3203	Pastoral Agronomy*	6
WOOL4113	Livestock Production 3*	6
WOOL5113	Livestock Production	12
ECON2109	Economics of Natural Resources*	3
GEOG3021	Biogeography*	3

GEOG2021	Introduction to Remote Sensing*	C 3
GEOG3051	Soils and Landforms*	3
GEOG3062	Environmental Change*	3
GEOG9240	Principles of Geographic Information Systems	3
GEOG9130	Soil Studies for Arid Lands Management	3
GEOG9300	Vegetation Management	3
GEOG9310	River Management	3
BIOS3014	Ecological Studies in Arid Lands Management	3

* Undergraduate level subjects. Additional subjects may be substituted with the permission of the Course Coordinator.

Graduate Programs in Remote Sensing

Programs are available leading to the award of:

- Master of Applied Science in Remote Sensing Course **8026**
- Graduate Diploma in Remote Sensing Course **5026**

8026**Remote Sensing Graduate Course**

**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, surveying, or in a relevant environmental biological or agricultural science.

Course requirements. Candidates are required to complete a course totalling 30 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

GEOG9150	Remote Sensing Applications	C 3
GEOG9330	Spatial Data Processing and Integration	3
GEOG9290	Image Analysis in Remote Sensing	3
SURV9600	Principles of Remote Sensing	3
GEOG9509	Project or	9
GEOL0124	Project or	9
GEOG9512	Project or	12
GEOL0114	Project	12

Elective Subjects

GEOG9210	Computer Mapping and Data Display	C
GEOG9240	Principles of Geographical Information Systems	3
GEOG9241	Advanced Geographical Information Systems	3
GEOG9250	Special Topic	3
GEOG9280	Applications and Management of GIS	3
GEOL0110	Geological Remote Sensing*	3
GEOL0310	Image Processing of Spatial Data Sets	3
GEOL0360	Remote Sensing Applications in Geoscience	3
SURV9532	Data Acquisitions and Terrain Modelling	3
SURV9602	Remote Sensing Procedures	3
SURV9605	Ground Investigations for Remote Sensing	3
SURV9606	Microwave Remote Sensing	3

* 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.

5026**Remote Sensing Graduate Diploma Course****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 24 credits or equivalent to 12 hours per week for two sessions of full-time study, made up of compulsory subjects (12 credits) and elective subjects (12 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

SURV9600	Principles of Remote Sensing	C
SURV9605	Ground Investigations for Remote Sensing	3
GEOG9150	Remote Sensing Applications	3
GEOG9290	Image Analysis in Remote Sensing	3

Elective Subjects

From the following (or as approved by the relevant Faculty):

CIVL9849	Irrigation	C
CIVL9861	Investigation of Ground Water Resources 2	3
CIVL9875	Hydrological Processes	3
ELEC9408	Computer Display Systems and Interactive Instrumentation	3
GEOL0110	Remote Sensing in Applied Geology	2
GEOL9060	Environmental Geology	3
GEOG9160	Directed Problems in Remote Sensing	3
GEOG9210	Computer Mapping and Data Display	3
GEOG9240	Principles of Geographic Information Systems	3
SURV9211	Introduction to Geodesy	3
SURV9213	Physical Meteorology	3
SURV9532	Data Acquisition and Terrain Modelling	3
SURV9604	Land Information Systems	3
SURV9606	Microwave Remote Sensing	3

Graduate Programs in Environmental Studies**8045****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.

Entry qualifications. Four-year Honours degree, or equivalent, in a field relevant to environmental studies.

Course requirements. Candidates are required to complete a course totalling 30 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.

See Entry Under Safety Science

8046**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 30 credits made up of compulsory subjects (9 credits), a project (9 credits), and elective subjects (12 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

GEOG9300	Vegetation management	C
GEOG9310	River management	3
GEOG9320	Soil degradation and conservation	3
GEOG9509	Project	9

Elective Subjects*

GEOG9150	Remote sensing applications	3
GEOG9240	Principles of Geographic Information Systems	3
GEOG9241	Advanced Geographic Information Systems	3
GEOG9250	Special topic	3
SAFE9273	Environment and the law	3
KCME4301	Environmental management	
SURV9600	Principles of remote sensing	

* Alternative subjects may be substituted approved by the Course Coordinator.

Subject Descriptions

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

GEOG9120

Settlement in Australia: Development and Change

Staff Contact: Dr S. Walker
C3 S2 L2

Problems and issues relating to urbanization in Australia. External influences on town planning, and subsequent modifications to urban structure, pattern of settlement, displacement and the role of immigration. Planned developments of growth centres; settlements in remote areas and differential urban growth. Socio-economic issues relating to inner city redevelopment and urban consolidation; outer suburban locations; and critical perspectives on the relationship between population density, housing conditions and behaviour patterns.

GEOG9130

Soil Studies for Arid Lands Management

Staff Contact: A/Prof M. Melville
C3 S1 or S2 L2 T4

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 salinization and alkalization. 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: Drs A. Skidmore, Q. Zhou & Mr A. Evans
C3 S1 L1 T2

The application of remotely-sensed data and information in the description, classification and assessment of earth resources and environmental conditions. Different types of remote sensing data and imagery, their attributes, acquisition and uses. Relevance of remote-sensing data and imagery to a range of applications, including assessment of conditions of terrain, soils and surface materials; multitemporal monitoring and inventory of rangelands, croplands and forests; rural and urban land use assessment; surveillance of surface water resources and sedimentation; appraisal of changes in the coastal zone. Use of remote sensing in environmental management and in environmental impact assessment.

GEOG9160

Directed Problems in Remote Sensing

Staff Contact: Dr A. Skidmore
C3 S2 T3

A detailed investigation of a particular aspect of remote sensing technology or an area of applications relevant to candidates interests and background.

GEOG9180**Environmental Planning and Evaluation***Staff Contact: Dr M. Sant*

C2 S1

Seminars on environmental problems, socio-economic assessment of policies and proposed developments, resource management.

GEOG9210**Computer Mapping and Data Display***Staff Contact: Prof B. Garner*

C3 S1 L2 T2

Introduction to automated cartography and thematic mapping; theoretical and practical problems in displaying and mapping data by computer; review and application of selected computer mapping packages. INFO is used for database management, and ARC/INFO and GIMMS for cartographic manipulation and output.

GEOG9230**Population, Health and Environment***Staff Contact: A/Prof I. Burnley*

C3 S2

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: Dr Q. Zhou*

C3 S1 L1 T3

Study of selected geographic information systems; problems of data capture and display, data storage and manipulation, system design and development; cartographic displays and computer mapping. INFO is used for database management, and ARC/INFO and MAP for spatial data manipulation and display.

GEOG9241**Advanced Geographical Information Systems***Staff Contact: Dr A. Skidmore*

C3 S1 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 ARC/INFO; INFO is used for data base management.

GEOG9250**Special Topic***Staff Contact: Dr M. Sant*

C3 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*

C3 S2 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 ARC/INFO or MAP. INFO is used for database management.

GEOG9290**Image Analysis of Remote Sensing***Staff Contact: Drs A. Skidmore & Mr A. Evans*

C3 S1 L1 T1

Techniques for extracting information from satellite imagery including image enhancement techniques, classification and feature recognition, statistical methods, and related procedures. Emphasis is on applications relating to vegetation cover and natural resource management. Practical work will be undertaken using the ERDAS image processing software.

GEOG9300**Vegetation management***Staff Contact: A/Prof J. Dodson, A/Prof M. Fox & Dr A. Skidmore*

C3 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*

C3 S1 L2 T1

Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

The principles of river management including total or integrated catchment management, environmental impact assessment, instream uses and hydrogeomorphic behaviour. Issues covered include regulated rivers, interbasin 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 and Dr W. Erksine*

C3 S2 L2 T1

Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

Identification, assessment and analysis of the main processes of soil degradation, including the role of climate, vegetation, geomorphology and pedology in controlling the processes. Discussions of appropriate management strategies for reducing degradation and for reclaiming degraded landscapes. Topics include: surface wash, gully 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

C3 S1 L1 T2

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, affine 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 ARC/INFO, ERDAS

and MAP to demonstrate the practical application of the topics.

GEOG9509

Project

Staff Contact: Dr A. Skidmore

C9 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: Drs M. Sant and A. Skidmore

C12

An investigation of a problem in remote sensing or geographical information systems which involves an identifiable research component. Such an investigation should be related to the research interests of particular Schools within the Faculty of Applied Science.

School of Materials Science and Engineering

Head of School

Professor D. J. Young

Administrative Assistant

Mr O. S. Andersen

At the basis of most of the technological advances of recent years, the explosion in new highly sophisticated materials is transforming everything in our manufactured environment, from the humble set of scissors to jet aircraft and America's Cup yachts. New advanced ceramics – lighter, harder and more stable at high temperatures than any metal – are finding applications in motor vehicle engines, electronic components and surgical implants. Manufacturers are looking to these and other sophisticated materials to meet the demands of the new high tech industries (such as lasers, electronics and fibre optics), or in the quest for enhanced fuel economy, durability or fabrication streamlining in their products.

Materials Science has been designated as a primary area for increased investment by the Federal Government in order to meet the expected growth of the materials industry in Australia, particularly in the more sophisticated applications such as electronic and electrical ceramics, high temperature materials, surface coatings, machine tool materials and engineering polymers. Increases in the number of graduates and postgraduates are anticipated over the coming decade. In addition, if Australia is to be competitive in the area of advanced materials, the manufacturing industry in this country will have to be developed and restructured, and this can be expected also to create new positions for materials graduates.

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 specialization 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 organizing ability frequently move into management if they have an interest in this side of the industry.

In Australia, a number of government research organizations are active in ceramic research, e.g. the Australian Nuclear Science and Technology Organization, 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 recognized 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 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, 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 sixteen 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.

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 manmade 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 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	
Year 1		S1	S2
CHEM1002	Chemistry 1	6	6
MATH1032	Mathematics 1	6	6
MATS1001	Introduction to Materials Industry	2	0
MATS1011	Introduction to Materials Engineering	1	0
MATS1021	Introduction to Computing	0	2
MECH0130	Engineering Drawing and Descriptive Geometry	4	0
MECH0440	Engineering Statics	0	3
PHYS1002	Physics 1	6	6
Totalling		25	23
Year 2			
CHEM2818	Physical Chemistry	5	0
MATH2021	Mathematics	2	2
MATS1002	Microstructural Analysis	0	3
MATS1022	Materials Process Principles	0	1
MATS1032	Materials Engineering 1A	3	0
MATS1042	Crystallography & X-ray Diffraction	4	0
MATS1052	Materials Engineering 1B	0	3
MATS1062	Mechanical Properties of Materials	4	0
MATS1072	Physics of Materials	3	0
MATS1082	Thermodynamics of Materials 1	0	3
MATS1092	Materials and Design 1	0	2
MATS1102	Numerical Methods	1	2
MATS1112	Phase Equilibria	0	2
General Education (Category A)		0	4
Totalling		22	22

		HPW	
Year 3		S1	S2
FUEL0040	Fuel Engineering for Ceramic Engineers	1	1
INDC3070	Instrumentation and Process Control 1	0	3
MATH2819	Statistics SA	2	0
MATS1093	Thermodynamics of Materials 2	2	0
MATS1113	Ceramic Process Principles 1	2	0
MATS1163	Chemistry of the Solid State	2	0
MATS2123	Ceramic Process Principles 2	0	2
MATS2133	Ceramic Raw Materials	2	0
MATS2143	Ceramic Equipment	0	3
MATS2153	Ceramic Processing Laboratory	3	3
MATS2183	Refractories	0	2
MATS2193	Origins of Microstructure (Units 1 & 2)	4	0
MATS2203	Physico Chemical Ceramics Laboratory	3	3
MATS2273	Chemistry of Ceramic Processes	0	2
MINE7341	Mineral Process Engineering	2	0
General Education (Category B)		0	4
Totalling		23	23
Year 4			
APSE0002	Social Issues in the Applied Sciences†	2	0
CEIC4010	Process Economics 1	1	0
CEIC4020	Process Economics 2	0	1
INDC4070	Laboratory Automation for Ceramic Engineers	2	0
MATS1244	Management	4	0
MATS1254	Design Project	2	2
MATS1294	Electrical Ceramics	0	3
MATS1464	Materials Seminar	2	2
MATS1534	Design with Brittle Materials	3	
MATS2244	Ceramic Process Engineering	2	0
MATS2254	Ceramic Engineering Design	0	2
MATS2264	Sintering of Ceramics	2	0
MATS2274	Mechanical Properties of Ceramics	0	2
MATS2284	Thermal Properties of Ceramics	0	2
MATS2304	Project (Ceramic Engineering)	6	6
MATS2324	Materials and Design 3 (Unit 1)	0	2
Totalling		26	22

†This subject and others in the professional program, contribute towards satisfaction of the Category C General Education requirement.

3030**Ceramic Engineering - Part-time Course****Bachelor of Science Technology
BScTech**

		HPW	
Stage 1		S1	S2
MATH1032	Mathematics	6	6
PHYS1002	Physics 1	6	6
Totalling		12	12
Stage 2			
CHEM1002	Chemistry 1	6	6
MATS1001	Introduction to Materials Industry	2	0
MATS1011	Introduction to Materials Engineering	0	1
MATS1021	Introduction to Computing	0	2
MECH0130	Engineering Drawing and Description Geometry	4	0
MECH0440	Engineering Statics	0	3
Totalling		12	12
Stage 3			
CHEM2818	Physical Chemistry	5	0
MATH2021	Mathematics	2	2
MATS1072	Physics of Materials	3	0
MATS1082	Thermodynamics of Materials 1	0	3
MATS1092	Materials and Design 1	0	2
MATS1102	Numerical Methods	1	2
General Education (Category A)		0	2
Totalling		11	11
Stage 4			
MATS1002	Microstructural Analysis	0	3
MATS1022	Materials Processes Principles	0	1
MATS1032	Materials Engineering 1A	3.5	0
MATS1042	Crystallography & X ray Diffraction	4	0
MATS1052	Materials Engineering 1B	0	3
MATS1062	Mechanical Properties of Materials	4	0
MATS1112	Phase Equilibria	0	2
General Education (Category A)		0	2
Totalling		11	11
Stage 5			
MATS1093	Thermodynamics of Materials 2	2	0
MATS1113	Ceramic Process Principles 1	2	0
MATS1163	Chemistry of the Solid State	2	0
MATS2123	Ceramic Process Principles 2	0	2
MATS2133	Ceramic Raw Materials	2	0
MATS2143	Ceramic Equipment	0	3
MATS2153	Ceramic Processing Laboratory	3	3
General Education (Category B)		0	4
Totalling		11	12

HPW

Stage 6		S1	S2
FUEL0040	Fuel Engineering for Ceramic Engineers	1	1
INDC3070	Instrumentation and Process Control 1	0	3
MATH2819	Statistics SA	2	2
MATS2273	Chemistry of Ceramic Processes	0	2
MATS2183	Refractories	0	2
MATS2193	Origins of Microstructure (Units 1 & 2)	4	0
MATS2203	Physico Chemical Ceramics Laboratory	3	3
MINE7341	Mineral Process Engineering	2	0
Totalling		12	13

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 sixteen 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	
Year 1		S1	S2
CHEM1002	Chemistry 1	6	6
MATH1032	Mathematics 1	6	6
MATS1001	Introduction to Materials Industry	2	0
MATS1011	Introduction to Materials Engineering	1	0
MATS1021	Introduction to Computing	0	2
MECH0440	Engineering Statics	0	3
MECH0130	Engineering Drawing and Descriptive Geometry	4	0
PHYS1002	Physics 1	6	6
Totalling		25	23
Year 2			
CHEM2818	Physical Chemistry	5	0
MATH2021	Mathematics	2	2
MATS1002	Microstructural Analysis	0	3
MATS1022	Materials Process Principles	0	1
MATS1032	Materials Engineering 1A	3	0
MATS1042	Crystallography and Xray Diffraction	4	0
MATS1052	Materials Engineering 1B	0	3
MATS1062	Mechanical Properties of Materials	4	0
MATS1072	Physics of Materials	3	0
MATS1082	Thermodynamics of Materials 1	0	3
MATS1092	Materials and Design 1	0	2
MATS1102	Numerical Methods	1	2
MATS1112	Phase Equilibria	0	2
General Education (Category A)*		0	4
Totalling		22	22
Year 3 (Physical Metallurgy Major)			
MATH2819	Statistics SA	2	2
MATS1043	Heat, Fluid and Mass Flow in Materials Processing	3	0
MATS1083	NonFerrous Alloys	0	3
MATS1093	Thermodynamics of Materials 2	2	0
MATS1203	Materials and Design 2	2	2
MATS1253	Ferrous Alloys	3	0
MATS1263	Alloy Steels	0	2
MATS4223	Mechanical Behaviour of Materials (Units 14 & 6,7)	4	6
MATS4363	Origins of Microstructure (Units 14)	7	3
MINE7341	Mineral Process Engineering	2	0
General Education (Category B)		0	4
Totalling		25	22

*Students who have completed two years' study at an approved tertiary institution are exempted from Category A.

Year 4 (Physical Metallurgy Major)

APSE0002	Social Issues in Applied Science	2	0
MATS1154	Advanced Materials	0	3
MATS1244	Management	4	0
MATS1254	Design Project	2	2
MATS1464	Materials Seminar	2	2
MATS3484	Welding Science and Technology (Unit 1)	0	1
MATS4104	Metallurgy Project	6	6
MATS4144	Professional Electives*	6	2
	Mechanical and Thermal Processing of Materials	0	2
MATS4324	Materials and Design 3	0	4
Totalling		22	22

Year 3 (Process Metallurgy Major)

FUEL0050	Fuel Engineering	1	2
INDC3070	Instrumentation & Process Control 1	0	3
MATS1043	Heat, Fluid and Mass Flow in Materials Processing	3	0
MATS1083	Nonferrous Alloys	0	3
MATS1093	Thermodynamics of Materials 2	2	0
MATS1203	Materials and Design 2	2	2
MATS1253	Ferrous Alloys	3	0
MATS1263	Alloy Steels	0	2
MATS2183	Refractories	0	2
MATS5203	Origins of Microstructure (Unit 1 Phase Equilibria)	2	0
MATS5213	Metallurgical Plant Practice (Part)	0	2
MATS5223	Mechanical Behaviour of Materials (Unit 4 Metal Forming Processes)	2	0
MATS5314	Kinetics and Mass Transfer in Metallurgical Processes	1	3
MATS5263	Extractive Metallurgy 1	2	5
MINE7341	Mineral Process Engineering	2	0
General Education (Category B)		4	0
Totalling		24	24

Year 4 (Process Metallurgy Major)

APSE0002	Social Issues in Applied Science†	2	0
MATS1154	Advanced Materials	0	3
MATS1164	Welding Sci and Technology	0	3
MATS1244	Management	4	0
MATS1254	Design Project	2	2
MATS1464	Materials Seminar	2	2
MATS4104	Metallurgical Engineering Project	6	6
MATS5224	Mechanical Behaviour of Materials (Unit 6 Quality Assur & Ctrl)	1	0
MATS5253	Metallurgical Reaction Engineering	0	2
MATS5324	Modelling Metallurgical Processes	4	0
Professional Electives*		5	3
MATS5384	Air Pollution Control in the Metallurgical Industry	0	1
Totalling		26	22

*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.

†This subject and others in the professional program contribute towards satisfaction of the Category C General Education requirement.

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 daytime classes, and up to one day 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. The course has recently been revised. 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	
Stage 1		S1	S2
MATH1032	Mathematics 1	6	6
PHYS1002	Physics 1	6	6
Totalling		12	12
Stage 2			
CHEM1002	Chemistry 1	6	6
MATS1001	Introduction to Materials Industry	2	0
MATS1011	Introduction to Materials Engineering	1	0
MATS1021	Introduction to Computing	0	2
MECH0440	Engineering Statics	0	3
MECH0130	Engineering Drawing and Description Geometry	4	0
Totalling		13	11
Stage 3			
CHEM2818	Physical Chemistry	5	0
MATH2021	Mathematics	2	2
MATS1072	Physics of Materials	3	0
MATS1082	Thermodynamics of Materials 1	0	3
MATS1092	Materials and Design 1	0	2
MATS1102	Numerical Methods	1	2
General Education (Category A)		0	2
Totalling		11	11

		HPW	
Stage 4		S1	S2
MATS1002	Microstructure Analysis	0	3
MATS1022	Materials Process Principles	0	1
MATS1032	Materials Engineering 1A	3	0
MATS1042	Crystallography and XRay Diffraction	4	0
MATS1052	Materials Engineering 1B	0	3
MATS1062	Mechanical Properties of Materials	4	0
MATS1112	Phase Equilibria	0	2
General Education (Category A)		0	2
Totalling		11	11
Stage 5			
MATS1083	Non-Ferrous Alloys	0	3
MATS1253	Ferrous Alloys	3	0
MATS4463	Origins of Microstructure (Units 13)	7	0
MATS7223	Mechanical Behaviour of Materials (Units 13 & 4A)	3	4
MINE7341	Mineral Process Engineering	2	0
General Education (Category B)		0	2
Totalling		15	9

Note: Unit 4A comprises part of Unit 4

Stage 6			
MATS1203	Materials and Design 2	2	2
MATS1464	Materials Seminar	2	2
MATS4144	Mechanical and Thermal Processing of Materials	0	2
MATS1263	Alloy Steels	2	0
MATS1164	Welding Science and Technology	0	3
MATS4204	Industrial Metallurgy Project	3	3
General Education (Category B)		2	0
Totalling		11	12

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	
Year 1		S1	S2
CHEM1002	Chemistry 1	6	6
MATH1032	Mathematics	6	6
MATS1001	Introduction to the Materials Industry	2	0
MATS1011	Introduction to Materials Engineering	1	0
MATS1021	Introduction to Computing	0	2
MECH0130	Engineering Drawing and Descriptive Geometry	4	0
MECH0440	Engineering Statics	0	3
PHYS1002	Physics 1	6	6
Totalling		25	23
Year 2			
CHEM2818	Physical Chemistry	5	0
MATH2021	Mathematics	2	2
MATS1022	Materials Process Principles	0	1
MATS1002	Microstructural Analysis	0	3
MATS1032	Materials Engineering 1A	3	0
MATS1042	Crysallography & Xray Diffraction	4	0
MATS1052	Materials Engineering 1B	0	3
MATS1062	Mechanical Properties of Materials	4	0
MATS1072	Physics of Materials	3	0
MATS1082	Thermodynamics of Materials 1	0	3
MATS1092	Materials and Design 1	0	2
MATS1102	Numerical Methods	1	2
MATS1112	Phase Equilibria	0	2
General Education (Category A)		0	4
Totalling		22	22

HPW**Year 3**

CEIC4010	Process Economics 1	1	0
MATH2819	Statistics SA	2	2
MATS1113	Ceramic Process Principles 1	2	0
MATS1163	Chemistry of the Solid State	2	0
MATS4363	Origins of Microstructure	7	3
MATS1203	Materials and Design 2	2	2
MATS3223	Mechanical Behaviour of Materials (Units 1,2,4,5)	4	3
MATS1253	Ferrous Alloys	3	0
MATS1093	Thermodynamics of Materials 2	2	0
MATS3443	Polymer Science and Engineering	0	6
MINE7341	Mineral Process Engineering	2	0
General Education (Category B)		0	4
Totalling		27	20

Year 4

MATS1083	Non-Ferrous Alloys	0	3
MATS1244	Management	4	0
MATS1254	Design Project	2	2
MATS1464	Materials Seminar	2	2
MATS4324	Materials and Design 3	0	4
MATS3484	Welding Science and Technology (Unit 1)	0	1
MATS3524	Materials Engineering Project	6	6
MATS3544	Polymer Engineering	3	3
Professional Electives		3	3
APSE0002	Social Issues in Applied Science†	2	0
Totalling		22	24

† This subject and others in the professional program contribute towards the satisfaction of the Category C General Education requirement.

Subject Descriptions

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

APSE0002**Social Issues in Applied Science**

Staff Contact: A/Prof C.C. Sorrell

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 C.C. Sorrell

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

S1 L1 T2

Specimen preparation techniques. Principles of optical microscopy. Quantitative microscopy and sterology. Electron microscopy. Microchemical analysis.

MATS1011**Introduction to Materials Engineering***Staff Contact: Dr A. G. Crosky*

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*

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.

MATS1022**Materials Process Principles***Staff Contact: School Office*

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: School Office*

S2 L1 T2.5

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 XRay Diffraction***Staff Contact: Dr P. Munroe*

S1 L2 T2

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: School Office*

S1 L2 T1

Transport processes. Application of transport principles to primary and secondary metallurgical practice. Course examples are drawn from metallurgical engineering practice in the broadest sense. Heat losses from BOS vessels and ladles. Slab cooling in hot strip mills. Interaction of free and submerged gas jets with melts. Accretion, stability, backwall and tuyere erosion. Continuous casting. Solidification in metal and sand moulds. Solute transference between liquid metals and slags. Vacuum and

magnesium desulphurisation of steel melts. Lead softening. Cementation. Role of line and point defects on reactivity.

MATS1052**Materials Engineering 1B***Staff Contact: School Office*

S2 L1 T2.5

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*

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 A.K. Hellier*

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, antiferromagnetism. Elementary perturbation theory, covalent bond; crystal structures, properties. Ionic bond, force models, properties.

MATS1082**Thermodynamics of Materials 1***Staff Contact: School Office*

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.

MATS1083**Nonferrous Alloys***Staff Contact: Dr P. Krauklis*

S2 L1 T2

Metallography of nonferrous alloys. Structure/property relationships in nonferrous alloys. Hardening mechanisms. Metallography and properties of copper, aluminium, nickel, magnesium, lead, tin and titanium based alloys.

MATS1092

Materials and Design 1

Staff Contact: Dr A. G. Crosky

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

S1 L2

Thermodynamics of solutions. Partial and integral thermodynamic functions, excess 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

F L1 T.5

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: School Office

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 crystallization: cooling curves, crystallization paths.

MATS1113

Ceramic Process Principles 1

Staff Contact: Mr S. Prokopovich

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.

MATS1154

Advanced Materials Unit 1 Magnetic Materials

Staff Contact: Dr S. Blairs

S1 or S2 L1

Interrelationship between the structure and properties of metallic and nonmetallic magnetic materials. Domain

magnetism. Magnetic anisotropy and control of magnetic properties by modification of microstructure. Magnetically soft and hard magnetic materials. Metallic glasses.

Unit 2 Heat Resisting Alloys

Staff Contact: Prof D.J. Young

S1 or S2 L1

Microstructure and properties of high temperature alloys, iron-base alloys, nickel-iron alloys, nickel-base, cobalt-base, and chromium-base alloys. Strengthening mechanisms. Creep, oxidation and hot corrosion. Coatings and protection. Process metallurgy and applications of high temperature alloys.

Unit 3 Fibre Reinforced Composites

Staff Contact: Dr A. G. Crosky

S1 or S2 L.5

Fibre composites, fibre and matrix materials, fabrication. Design with fibre composites. Mechanical properties and environmental effects, corrosion, fatigue, creep and damage tolerance.

Unit 4 Titanium alloys

Staff Contact: Dr P. Munroe

S1 or S2 L.5

Classification of titanium alloys. Commercial alloys, aerospace and corrosion resistant alloys. Heat treatment, strengthening mechanisms, superplastic forming, forging, powder metallurgy.

MATS1163

Chemistry of the Solid State

Staff Contact: A/Prof C.C. Sorrell

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, nonoxides, aluminosilicates).

MATS1164

Welding Science and Technology

Unit 1 Welding Technology

Staff Contact: Dr A.G. Crosky

S1 or S2 L1

Fusion welding and allied processes. Capabilities, advantages and limitations.

Unit 2 Welding Metallurgy

Staff Contact: Dr A.G. 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.

MATS1203

Materials and Design 2

Unit 1 Design for Corrosion Control

Staff Contact: Prof D.J. 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.

MATS1244

Management

Staff Contact: Mr S. Prokopovich

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 intergroup 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.

MATS1253

Ferrous Alloys

Staff Contact: Dr P. Krauklis

S2 L1 T2

Ferrous alloys. Iron-carbon phase equilibrium diagrams. Microstructure and properties of plain carbon steels. Austenite decomposition under equilibrium and nonequilibrium conditions. Dilatometry. Heat treatments of steels. Surface hardening treatments. Microstructure and properties of ordinary cast irons, including grey, white, mottled, malleable and ductile irons.

MATS1254

Design Project

Staff Contact: Dr S. Bandyopadhyay

F L0.25 T1.75

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.

MATS1263

Alloy Steels

Staff Contact: Dr P. Krauklis

S2 L1 T1

Alloy steels. Ternary equilibria involving iron and carbon. Metallography and properties of alloy steels. Effects of alloying elements on austenite formation and decomposition under equilibrium and non-equilibrium conditions. Heat treatment of alloy steels. Metallography and properties of alloy cast irons.

MATS1294

Electrical Ceramics

Staff Contact: Dr S. Blairs

S1 or S2 L1 T2

The intrinsic and extrinsic disorder of ceramic phases. Highly conductive ceramics. Grain boundary phenomena. Electronic and surface conduction. Insulators and substrates. Structure and property relations in ceramic capacitor materials. Piezo and pyroelectric ceramics. Processing, applications and sensors.

MATS1464

Materials Seminar

Staff Contact: A/Prof C.C. Sorrell

F T2

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: School Office

S1 L1.5 T1.5

General design considerations. Nature and properties of ceramic materials: glasses, polycrystalline ceramics and other ceramic materials. Effects of composition and microstructure on physical properties of ceramics. Manufacture of ceramic materials. Design approaches for ceramics: empirical, deterministic, probabilistic and linear elastic fracture mechanics. Effects of time under load. Design of components and selection of materials. Inspection and nondestructive testing.

MATS2123

Ceramic Process Principles 2

Staff Contact: Mr S.A. Prokopovich

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 S.A. Prokopovich

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 S.A. Prokopovich

S2 L3

The principles of operation, construction and fields of application of equipment used in the ceramic industry in the following areas: mining and beneficiation; preparation of raw materials and auxiliary processing operations; forming, drying and firing of ceramic products.

MATS2153**Ceramic Processing Laboratory**

Staff Contact: Mr S.A. Prokopovich
F T3

Laboratory programme 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 C.C. Sorrell
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.

MATS2193**Origins of Microstructure****Unit 1 Phase Equilibria**

Staff Contact: Dr A.G. Crosky
S1 L1 T1

Phase rule. Two-component systems: free energy composition and temperature-composition diagrams, solubility limits, compound formation, invariants. Three-component systems: isothermal sections and liquidus projections. Solidification and crystallization; cooling curves, crystallization paths.

Unit 2 Diffusion

Staff Contact: Dr A.K. Hellier
S1 L1 T1

Fick's first and second laws. Solutions for short and long times by analytical and numerical methods. Boundary conditions for solid-fluid and solid-solid interfaces. Diffusion couples. Atomic level diffusion theory.

MATS2203**PhysicoChemical Ceramics Laboratory**

Staff Contact: A/Prof C.C. Sorrell
S1 T3 S2 T4

Laboratory programme 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.

MATS2244**Ceramic Process Engineering**

Staff Contact: Mr S.A. Prokopovich
S1 L2

Advanced treatment of fluid flow and heat transfer: nonNewtonian fluids and unsteady state heat transfer. Flow through porous media. A detailed study of ceramic forming methods.

MATS2254**Ceramic Engineering Design**

Staff Contact: Mr S.A. Prokopovich
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 C.C. Sorrell
S1 L1.5 T.5

Defects and phase transitions. Recrystallization, 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 C.C. Sorrell
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.

MATS2274**Mechanical Properties of Ceramics**

Staff Contact: School Office
S2 L2

Elasticity and anelasticity, submicroscopic flaw theory, nucleation and formation of crack, and brittle fracture and crack propagation. Atomistic and microstructural aspects of crack propagation. Fracture strength of ceramics, fracture toughness, R-curve behaviour, static fatigue, impact resistance and microhardness. High-temperature effects (strength, creep, creep rupture, viscous deformation, thermal stresses, thermal shock).

MATS2284**Thermal Properties of Ceramics**

Staff Contact: A/Prof C.C. Sorrell
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
F T6

An experimental or technical investigation or design related to some aspects of ceramic engineering.

MATS2324**Materials and Design 3****Unit 1 Fracture Mechanics**

Staff Contact: Dr A.K. Hellier
S1 or S2 L1 T1

Brief review of theory of elasticity. Brittle fracture and strength theories. Quantitative design against fracture in

terms of linear elastic fracture mechanics and elastic-plastic fracture mechanics using COD and Jintegral approaches. Application of fracture mechanics to fatigue. Case studies. Engineering design codes of practice.

MATS3223

Mechanical Behaviour of Materials (Units 1,2,4, & 5)

Unit 1 Deformation

Staff Contact: Dr P. Munroe

S1 L2

Atomic and molecular description of deformation. Introduction to dislocation theory and its application of mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic Analysis

Staff Contact: Dr A.G. Crosky

S2 L1 T1

Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning and transmission electron microscopy.

Unit 4 Metal forming processes

Staff Contact: Dr A.G. Crosky

S1 L1 T1

Metal forming. Introduction to metal forming operations. Factors affecting deformation and workability. Hot working, cold working and recrystallization. Processes: forging, rolling, extrusion and wire drawing. Die materials and geometry. Deformation parameters and processing defects. Plant visits.

Unit 5 Polymer forming processes

Staff Contact: Dr S. Bandyopadhyay

S2 L1

Industrially significant manufacturing processes.

MATS3324

Materials and Design 3 (Units 1 & 2)

Unit 1 Fracture Mechanics

Staff Contact: Dr A. K. Hellier

S1 or S2 L1 T1

Brief review of theory of elasticity. Brittle fracture and strength theories. Quantitative design against fracture in terms of linear elastic fracture mechanics and elasticplastic fracture mechanics using COD and J-integral approaches. Application of fracture mechanics to fatigue. Case studies. Engineering design codes of practice.

MATS3443

Polymer Science and Engineering

Staff Contact: Dr S. Bandyopadhyay

S2 L4 T2

Polymer structure. Mers, bond strength, functionality. Addition and condensation polymerisation. 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.

MATS3484

Welding Science and Technology

Unit 1 Welding Technology

Staff Contact: Dr A.G. Crosky

S1 or S2 L1

Fusion welding and allied processes. Capabilities, advantages and limitations.

MATS3524

Materials Engineering Project

Staff Contact: Dr A.G. Crosky

F6

An experimental or technical investigation or design related to some aspects of materials engineering.

MATS3544

Polymer Engineering

Staff Contact: Dr S. Bandyopadhyay

F L2 T1

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 additives and fillers on performance. Abrasion resistance. Strategies to reduce stress and increase toughness. Creep, recovery and stress relaxation. Timetemperature superposition. Fatigue. Selection of commodity plastics, engineering plastics and elastomers for particular applications. Adhesives. Mechanisms of adhesion. Coatings. Properties and performance requirements of coatings. Degradation. Weathering, thermal resistance, radiation resistance and resistance to other environments.

MATS4104

Metallurgy Project/Metallurgical Engineering Project

Staff Contact: Dr A.G. Crosky

F6

An experimental investigation of some aspects of metallurgy or metallurgical engineering.

MATS4144

Mechanical and Thermal Processing of Materials

Unit 1 Deformation and Forming of Sheet Metal

Staff Contact: Dr A.G. Crosky

S1 or S2 L1

Mechanisms of deformation. Origin of rolling and annealing textures. Inhomogeneities of deformation. Texture control and controlled rolling. Application to transformer steel, HSLA steel, deepdrawing steel, tungsten filaments. Superplasticity, creep, deformation maps. Sheet metal forming. Industrial operations of cutting, piercing, blanking, folding, bending, stretching, flow turning, deep drawing. Materials requirements for dies and sheet. Assessment of formability. Forming limit diagrams.

Unit 2 Powder Metallurgy

Staff Contact: School Office

S1 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 superalloys.

MATS4174

Staff Contact: Dr S. Bandyopadhyay
S1 or S2 L.5 T.5

Metal Matrix Composites (MMC) - their advantages and scope. Potential applications, limitations. Various systems of MMC's: role of interfaces. Fabrication techniques. Mechanical and Fracture Properties. Effect of volume fraction and size, size distributions and shape of reinforcement. Other properties such as creep, fatigue, corrosion, machinability.

MATS4204**Industrial Metallurgy Project**

Staff Contact: Dr A.G. Crosky
F3

An experimental investigation of some aspect of industrial metallurgy.

MATS4223**Mechanical Behaviour of Materials (Units 1, 2, 3, 4, 6 & 7)****Unit 1 Deformation**

S1 L2

Staff Contact: Dr P. Munroe

Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic Analysis

S2 L1 T1

Staff Contact: Dr A.G. Crosky

Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning and transmission electron microscopy.

Unit 3 Deformation and Strengthening Mechanisms

Staff Contact: Dr B. Gleeson

S2 L1 T1

Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallization textures. Measurements of age-hardening, activation energy of strain ageing.

Unit 4 Metal Forming Processes

Staff Contact: Dr A.G. Crosky

S1 L1 T1

Metal forming. Introduction to metal forming operations. Factors affecting deformation and workability. Hot working, cold working and recrystallization. Processes: forging, rolling, extrusion and wire drawing. Die materials and geometry. Deformation parameters and processing defects. Plant visits.

Unit 6 Quality Assurance and Control

Staff Contact: Dr A.G. Crosky

S2 L1

Concepts of quality assurance and quality control. Techniques of liquid penetrant, magnetic particle ultrasonic, radiographic and eddy current inspection. Systems and processes, inspection and evaluation,

acceptance standards, case studies. Optimisation of quality assurance and control.

Unit 7 Advanced Fractographic Analysis

Staff Contact: Dr A.G. Crosky

S2 L.5 T.5

Extension of fractographic analysis to include creep, hydrogen embrittlement and corrosion fatigue. Analysis of service failures using metallographic and fractographic techniques.

MATS4324**Materials and Design 3****Unit 1 Fracture Mechanics**

Staff Contact: Dr A. K. Hellier

S1 or S2 L1 T1

Brief review of theory of elasticity. Brittle fracture and strength theories. Quantitative design against fracture in terms of linear elastic fracture mechanics and elasticplastic fracture mechanics using COD and J-integral approaches. Application of fracture mechanics to fatigue. Case studies. Engineering design codes of practice.

Unit 3 Design for Welding

Staff Contact: Dr A.G. Crosky

S1 or S2 L1 T1

Design of welded fabrications to reduce distortion and the risk of failure by fatigue, brittle fracture, etc.. Welding application codes, weld quality requirements and quality assurance with welded fabrication.

MATS4363**Origins of Microstructure (Units 1,2,3,4)****Unit 1 Phase Equilibria**

Staff Contact: Dr A.G. Crosky

S1 L1 T1

Phase rule. Two-component systems: free energy-composition and temperature-composition diagrams, solubility limits, compound formation, invariants. Three-component systems: isothermal sections and liquidus projections. Solidification and crystallization; cooling curves, crystallisation paths.

Unit 2 Diffusion

Staff Contact: Dr A.K. Hellier

S1 L1 T1

Fick's first and second laws. Solutions for short and long times by analytical and numerical methods. Boundary conditions for solid-fluid and solid-solid interfaces. Diffusion couples. Atomic level diffusion theory.

Unit 3 Metallography and Phase Equilibrium**Laboratory**

Staff Contact: Dr A.G. Crosky

S1 T3

Determination of equilibrium phase diagrams. Solidification processes in moulds. Metallography of nonferrous alloys.

Unit 4 Phase Transformations

Staff Contact: Dr B. Gleeson

S2 L2 T1

Solidification: single phase, eutectic and neareutectic, peritectic. Diffusional transformations: precipitation, ripening, cooperative transformations, TTT and CCT curves. Diffusionless transformations: crystallography, nucleation and growth modes.

MATS4463**Origins of Microstructure Double Degree and BSc(Tech) (Units 1,2,3)****Unit 1 Phase Equilibria***Staff Contact: Dr A.G. Crosky*

S1 L1 T1

Phase rule. Two-component systems: free energy-composition and temperature-composition diagrams, solubility limits, compound formation, invariants. Three-component systems: isothermal sections and liquidus projections. Solidification and crystallization; cooling curves, crystallisation paths.

Unit 2 Diffusion*Staff Contact: Dr A.K. Hellier*

S1 L1 T1

Fick's first and second laws. Solutions for short and long times by analytical and numerical methods. Boundary conditions for solid-fluid and solid-solid interfaces. Diffusion couples. Atomic level diffusion theory.

Unit 3 Metallography and Phase Equilibrium**Laboratory***Staff Contact: Dr A.G. Crosky*

S1 T3

Determination of equilibrium phase diagrams. Solidification processes in moulds. Metallography of nonferrous alloys.

MATS5203**Origins of Microstructure****Unit 1 Phase Equilibria***Staff Contact: Dr A.G. Crosky*

S1 L1 T1

Phase rule. Two-component systems: free energy-composition and temperature-composition diagrams, solubility limits, compound formation, invariants. Three-component systems: isothermal sections and liquidus projections. Solidification and crystallization; cooling curves, crystallization paths.

MATS5213**Metallurgical Plant Practice***Staff Contact: School Office*

S1 or S2 T2.5

Up to 3 days of metallurgical plant inspections and case studies equivalent to 35 tutorial hours are associated with this subject. Ferrous and non-ferrous plant practice.

MATS5223**Mechanical Behaviour of Materials****Unit 4 Metal forming Processes***Staff Contact: Dr A.G. Crosky*

S1 L1 T1

Metal forming. Introduction to metal forming operations. Factors affecting deformation and workability. Hot working, cold working and recrystallization. Processes: forging, rolling, extrusion and wire drawing. Die materials and geometry. Deformation parameters and processing defects. Plant visits.

MATS5224**Mechanical Behaviour of Materials****Unit 6 Quality Assurance and Control***Staff Contact: Dr A.G. Crosky*

S1 or S2 L1

Concepts of quality assurance and quality control. Techniques of liquid penetrant, magnetic particle, ultrasonic, radiographic and eddy current inspection. Systems and processes, inspection and evaluation, acceptance standards, case studies. Optimisation of quality assurance and control.

MATS5253**Metallurgical Reaction Engineering***Staff Contact: Dr O. Ostrovski*

S1 or S2 L2

Metallurgical reactor design: batch and flow reactors. Gas-solid reactions. Design of the roasting and reduction processes. Limiting laws for gas-liquid reactions in steelmaking processes. Liquid-liquid reactions, design of extractive and refining operations.

MATS5263**Extractive Metallurgy***Staff Contact: School Office*

S1 L2 S2 L2 T3

A review of the unit operations used in the iron and steel industry, sintering, pelletisation, iron blast furnace, desulphurisation, steelmaking, deoxidation and ladle metallurgy, direct reduction, plasma developments, mini steel plant. Unit operations for the treatment of non-ferrous minerals, roasting, sintering, smelting, refining and electrowinning.

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*

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 A. Yu*

S2 L3 T1

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, coalescence of inclusions, modelling metal flow and solidification, blast furnace drainage, mathematical plasticity, estimation of stresses developed during industrial deformation processes, rolling, drawing, bending.

MATS5384**Air Pollution Control in the Metallurgical Industry***Staff Contact: School Office*

S1 or S2 L5 T.5

Case studies of emission surveys, measurements and compliance program planning in the primary and secondary metallurgical industries.

MATS7134**Structure and Properties of Metallurgical Phases****Unit 1 Structure and Properties of Solids***Staff Contact: School Office*

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: School Office*

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**Mechanical and Thermal Processing of Materials****Unit 2 Powder Metallurgy***Staff Contact: Dr M. Edirisinghe*

S1 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.

MATS7154**Advanced Materials****Unit 1 Magnetic Materials***Staff Contact: School Office*

S1 or S2 L1

Interrelationship between the structure and properties of metallic and non-metallic magnetic materials. Domain magnetism. Magnetic anisotropy and control of magnetic properties by modification of microstructure. Magnetically soft and hard magnetic materials. Metallic glasses.

Unit 2 Heat Resisting Alloys*Staff Contact: Prof D.J. Young*

S1 or S2 L1

Microstructure and properties of high temperature alloys, ironbase alloys, nickel-iron alloys, nickel-base, cobalt-base, and chromium-base alloys. Strengthening mechanisms. Creep, oxidation and hot corrosion. Coatings and protection. Process metallurgy and applications of high temperature alloys.

MATS7164**Welding Science and Technology Unit Welding****Metallurgy***Staff Contact: Dr A.G. Crosky*

S1 or S2 L1 T1

Metallurgical aspects of fusion welding and allied processes. Causes of welding defects and weldability of carbon and alloy steels, stainless steels, aluminium and

other common non-ferrous alloys. Assessment of welds by mechanical testing and non-destructive methods.

MATS7223**Mechanical Behaviour of Materials (Units 1, 3 & 4A)****Unit 1 Deformation***Staff Contact: Dr P. Munroe*

S1 L2

Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic Analysis*Staff Contact: Dr A.G. Crosky*

S2 L1 T1

Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning transmission electron microscopy.

Unit 3 Deformation and Strengthening Mechanisms*Staff Contact: Dr B. Gleeson*

S2 L1 T1

Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallization textures. Measurements of age-hardening, activation energy of strain ageing.

Unit 4 (Part of) Metal Forming Processes*Staff Contact: Dr A.G. Crosky*

S1 L1 T1

Metal forming. Introduction to metal forming operations. Factors affecting deformation and workability. Hot working, cold working and recrystallization. Processes: forging, rolling, extrusion and wire drawing. Die materials and geometry. Deformation parameters and processing defects. Plant visits.

MATS7244**Advanced Electron Optics***Staff Contact: Dr P. Munroe*

S1 or S2 L1 T1

See School for details.

MATS7384**Air Pollution Control in the Metallurgical Industry***Staff Contact: School Office*

S1 or S2 L5 T.5

Case studies of emission surveys, measurements and compliance program planning in the primary and secondary metallurgical industries.

MATS7470**Polymer Processing and Fabrication***Staff Contact: Dr S. Bandyopadhyay*

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: School Office

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

S1 or S2 L1

Experimental methods for the determination of thermophysical and thermochemical properties at elevated temperatures.

MATS7500

Mathematical Plasticity

Staff Contact: Dr A.K. Hellier

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.

MATS8193

Origins of Microstructure

Unit 1 Phase Equilibria

Staff Contact: Dr A.G. Crosky

S1 L1 T1

Phase rule. Two-component systems: free energy-composition and temperature-composition diagrams, solubility limits, compound formation, invariants. Three-component systems: isothermal sections and liquidus projections. Solidification and crystallization; cooling curves, crystallization paths.

Unit 2 Diffusion

Staff Contact: Dr A.K. Hellier

S1 L1 T1

Fick's first and second laws. Solutions for short and long times by analytical and numerical methods. Boundary conditions for solid-fluid and solid-solid interfaces. Diffusion couples. Atomic level diffusion theory.

Unit 3 Metallography and Phase Equilibrium Laboratory

Staff Contact: Dr A.G. Crosky

S1 T3

Determination of equilibrium phase diagrams. Solidification processes in moulds. Metallography of non-ferrous alloys.

MATS9193

Origins of Microstructure

Unit 2 Diffusion

Staff Contact: Dr A.K. Hellier

S1 L1 T1

Fick's first and second laws. Solutions for short and long times by analytical and numerical methods. Boundary conditions for solid-fluid and solid-solid interfaces. Diffusion couples. Atomic level diffusion theory.

Unit 4 Phase Transformations

Staff Contact: Dr B. Gleeson

S2 L2 T1

Solidification: single phase, eutectic and near-eutectic, peritectic. Diffusional transformations: precipitation, ripening, cooperative transformations, TTT and CCT curves. Diffusionless transformations: crystallography, nucleation and growth modes.

MATS9223

Mechanical Behaviour of Materials (Units 1,2,3,7)

Unit 1 Deformation

Staff Contact: Dr P. Munroe

S1 L2

Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic analysis

Staff Contact: Dr A.G. Crosky

S2 L1 T1

Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning and transmission electron microscopy.

Unit 3 Deformation and strengthening mechanisms

Staff Contact: Dr B. Gleeson

S2 L1 T1

Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallization textures. Measurements of age-hardening, activation energy of strain ageing.

Unit 7 Advanced fractographic analysis

Staff Contact: Dr A.G. Crosky

S2 L.5 T.5

Extension of fractographic analysis to include creep, hydrogen embrittlement and corrosion fatigue. Analysis of service failures using metallographic and fractographic techniques.

MATS9323

Mechanical Behaviour of Materials (Units 1,2,3)

Unit 1 Deformation

Staff Contact: Dr P. Munroe

S1 L2

Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic Analysis

Staff Contact: Dr A.G. Crosky

S2 L1 T1

Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning and transmission electron microscopy.

Unit 3 Deformation and Strengthening Mechanisms*Staff Contact: Dr B. Gleeson***S2 L1 T1**

Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallization textures. Measurements of age-hardening, activation energy of strain ageing.

MATS9420**Materials for Mining Engineers***Staff Contact: Dr P. Krauklis***F L2 T1**

Solidification of metals, structure and defects in castings and welds. Phase equilibrium and strengthening mechanisms in alloys - application to engineering materials, including ferrous and non-ferrous alloys. Non-equilibrium structures, heat treatment and modification of structures and properties. Elastic and plastic deformation. Mechanical properties of solids and their significance. Mechanical testing: tension, hardness, impact. Stress-strain-time relationships and the influence of stress state, temperature, strain rate and environment. Corrosion. Fracture and fatigue. Use of hardfacing and carbides in minimising wear of mining machinery.

MATS9520**Engineering Materials***Staff Contact: Dr A.G. Crosky***S1 L2 T1**

Microstructure and structure-property relationships of the main types of engineering materials (Metals, Ceramics, Polymers and Composites). Micromechanisms of elastic and plastic deformation. Fracture mechanisms for ductile, brittle, creep and fatigue modes of failure in service; corrosion. Metal forming by casting and wrought processes. Phase Equilibria of alloys; microstructural control by thermomechanical processing and application to 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 C.C. Sorrell***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***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: School Office***S1 L2**

The application of thermodynamics to the understanding of pyrometallurgical processes and a review of the unit operations, roasting, sintering, smelting and refining for the treatment of ferrous and non-ferrous minerals.

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, or Doctor of Philosophy in metallurgy or ceramic engineering or who are interested in programs involving formal course work and research leading to the award of Master of Applied Science in Engineering Materials or Master of Applied Science in Corrosion Engineering.

Information about research scholarships, fellowships and grants in-aid is available from the Head of School 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. A specialist course of study of Corrosion Technology is available as part of the degree, if desired.

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 students' needs.

Compulsory Core

		HPW	
		S1	S2
MATS6475	Materials Science and Engineering	3	3
MATS6485	Materials Technology	3	3
MATS6405	Graduate Materials Seminar	2	2
Totalling		8	8
Project			
MATS6555	Minor Graduate Materials Project	3	3
or			
MATS6415	Graduate Materials Project or	6	6
MATS6565	Major Graduate Materials Project	9	9

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.

Depending on the candidate's background, enrolment in a limited number of 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	S2
MATS6475	Materials Science and Engineering	3	3
MATS6495	Corrosion Materials	4	2
MATS6545	Corrosion Technology	3	3
MATS1092	Materials and Design 1	0	2
MATS6203	Design for Corrosion Control	0	2
MATS6535	Industrial Coatings for Corrosion Protection	2	0
MATS6005	Corrosion Project	6	6
Totalling		18	18

**UNSW graduates who have done MATS9542 (4.952, 5.4222), CIVL2402 (8.240) AND/OR MATS9530 (4.913), CIVL4403 (8.440) must substitute other appropriate subjects approved by the Head of School of Materials Science and Engineering.*

Subject Descriptions

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

MATS1092

Materials and Design 1

Staff Contact: School Office

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 successful materials processing plants.

MATS6005

Corrosion Project

Staff Contact: School Office

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 D.J. 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.

MATS6405

Graduate Materials Seminar

Staff Contact: School Office

F HPW2

Instruction in written or 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

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

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

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

S1 L2

Special topics on heavyduty organic, inorganic and metallic coatings using in atmospheric, marine and industrial environments.

MATS6545

Corrosion Technology

Staff Contact: School Office

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

F HPW3

A small technical investigation or a design project, including a written report.

MATS6565

Major Graduate Materials Project

Staff Contact: School Office

F HPW9

A substantial experimental or theoretical investigation, or design project, including a written thesis.

Head of School

Associate Professor G.R. Taylor

The School of Mines, which was formed in 1986, consists of two Departments and two Centres corresponding to the main professions on which the mining and minerals industry of Australia depends. These are the Departments of Applied Geology and Mining Engineering, and the Centre for Minerals Engineering (in conjunction with the School of Chemical 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 Mineral 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. The Mining Engineer decides if the deposit is worth mining, 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.

Each is an expert in her or his own field, but each also needs to have a good appreciation of the work of the other two. 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, 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 C.R. 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.

General Education Electives

For details of changes in the General Education requirements see Faculty Information

Department of Mining Engineering

Head of Department

Associate Professor G.C. Sen

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 the 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 Managers 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.

General Education Electives

For details of changes in the General Education requirements see Faculty Information

Key Centre for Mines

Director:
Associate Professor G.R.Taylor

The Key Centre is a joint initiative of the Universities of New South Wales and Wollongong. Funded by the Department of Employment, Education and Training. The purpose of the Key Centre for Mines is to provide a full range of educational and research services to the minerals industries.

Particular emphasis is being placed on continuing education, distance learning 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.

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 over four years full-time study, with honours for students who perform with merit throughout the course program.

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 are advised to take chemistry at the introductory level in Year 1, this incurs no extension to the duration of the

course. 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), 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 of high academic standing.

3000

Applied Geology - Full-time

Bachelor of Science

BSc

		HPW	
Year 1		S1	S2
CHEM1002	Chemistry 1 or	6	6
CHEM1302	Introductory Chemistry	6	6
MATH1032	Mathematics 1 or	6	6
MATH1011	General Mathematics 1B	6	0
and			
MATH1021	General Mathematics 1C	0	6
GEOL1101	Geological Processes	6	0
and			
GEOL1201	Geological Environments	0	6
and either			
PHYS1002	Physics 1 or	6	6
PHYS1022	Introductory Physics or	6	6
BIOS1011	Biology A	6	0
and			
BIOS1021	Biology B or	0	6
GEOG1051	Global Environmental Problems & Processes	3	0
and			
GEOG1031	Environmental Processes	0	4
Totalling		22	24
Year 2			
GEOL2011	Mineralogy and Igneous Petrology	5	0
	Field	1	
GEOL2031	Sedimentology and Palaeontology	5	0
	Field	1	
GEOL2022	Petrology and Structural Geology	0	5
	Field	1	
GEOL2041	Geological Computing	3	0
GEOL2042	Geological Statistics	0	3
GEOL2051	Introductory Geophysics	3	0
GEOL2062	Geological Mapping	0	3
GEOL2072	Environmental Geology	0	3
GEOL2092	Geochemistry	0	3
General Education Subject/s (Category A)		2	2
Totalling		20	20

		HPW	
Year 3		S1	S2
GEOL3011	Mineralogical Techniques	3	0
GEOL3021	Igneous and Metamorphic Processes	3.5	0
	Field	0.5	
GEOL3031	Stratigraphy and Basin Analysis*	5	0
	Field	1	
GEOL3052	Exploration Geophysics	0	3
	Field	1	
GEOL3072	Engineering Geology	0	3
GEOL3082	Structural Geology	0	2
	Field	1	
GEOL3092	Exploration Geochemistry	0	2
GEOL3101	Ore Deposits	5	0
	Field	1	
GEOL3102	Fossil Fuels and Non-metallic Resources	0	5
	Field	1	
General Education Subject/s (Category B)		2	2
Totalling		21	20

Year 4

GEOL4111	Advanced Geological Techniques*	6	0
GEOL4121	Professional Practice*	4	0
GEOL4131	Special Topics in Applied Geology*	8	0
GEOL4203	Field Project	0	20
APSE0002	Social Issues in Applied Science	2	0
Totalling		20	20

*These subjects contribute towards the satisfaction of the Category C General Education requirement.

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.

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 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.

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 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	
Year 1		S1	S2
PHYS1002	Physics 1	6	6
CHEM1807	Chemistry 1 ME	6	0
MINE0010	Applied Mechanics	3	0
MINE0110	Stress Analysis 1	0	3
MINE0210	Introduction to Mining Engineering*	0	1
MINE0410	Technical Communication	0	2
MINE0710	Computing 1	0	2
MATH1032	Mathematics 1	6	6
Totalling		21	20

Year 2			
PHYS2920	Electronics	3	0
MATS9420	Materials for Mining Engineers	3	2
ELEC0802	Electrical Power Engineering	0	3
MINE0120	Stress Analysis	3	0
MINE1320	Fluid Mechanics and Thermodynamics	2	1
MINE1321	Mine Water and Drainage	0	1
MINE1420	Elements of Mining*	1	0
MATH2009	Engineering Mathematics 2	4	4
MATH2819	Statistics SA	2	2
SURV0441	Surveying for Engineers	0	4.5
GEOL5211	Geology for Mining Engineers 1**	2	2
General Education Subject/s (Category A)		2	2
Totalling		22	21.5

Year 3			
MINE1131	Mining of Metalliferous Deposits	3	0
MINE1132	Mining of Coal Deposits	3	0
MINE1231	Rock Mechanics	0	4
MINE1232	Soil Mechanics	0	2
MINE1330	Bulk Materials Handling & Transport	2	0
MINE1530	Power Supply in Mines	0	2
MINE1630	Excavation Engineering (Blasting)*	2	0
MINE1631	Excavation Engineering (Machine Mining)	0	1
MINE1830	Mine Ventilation and Environment	0	4
MINE7342	Minerals Engineering Processes	2	2
GEOL5311	Geology for Mining Engineers 2	3	3
SURV0580	Mining Surveying	3	0
MINE1930	Industrial training	0	0
General Education Subject/s (Category B)		2	2
Totalling		20	20

Year 4		HPW	
MINE1140	Geotechnical Engineering	2	2
MINE1740	Mining Legislation	0	2
MINE2141	Mineral Economics	2	0
MINE2142	Mine Planning and Design	3	3
MINE2240	Mining Management	0	3
MINE3040	Mine Safety Engineering	0	3
MINE3041	Hazard and Risk in Mining	2	0
MINE4140	Minerals Industry Project	4	4
MINE4240	Industrial and Research Seminars	1	1
MINE4540	The Mining Engineering Profession in Society***	0	2
APSE0002	Social Issues in Applied Science***	2	0

together with an approved group of two advanced elective subjects selected from the following:

Advanced Electives

MINE1940	Tunnel Engineering and Shaft Sinking	2	0
MINE7440	Mineral Process Technology	2	0
MINE3140	Computational Methods in Geomechanics	2	0
MINE3240	Operations Research	2	0
Totalling		20	20

*Visits to mines and related undertakings are requirement for this subject.

** Includes two compulsory field tutorials.

***These subjects contribute towards the satisfaction of the Category C General Education requirement.

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.

Department of Applied Geology

Field tutorials are a compulsory part of many of the following subjects and are held during weekends and/or recesses. Dates and personal costs are available during the first week of the subject.

APSE0002

Social Issues in Applied Science

Staff Contact: Applied Geology Office

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.

GEOL1101

Geological Processes

Staff Contact: Dr M.D. Buck

S1 L3 T2

Prerequisites: HSC Exam Score Range Required - 2 unit Mathematics 55-100, or 3 unit Mathematics 1-50 or 4 unit Mathematics 1-100, and 2 unit 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 M.D. Buck

S2 L3 T2

Prerequisites: GEOL1101

Note/s: Up to 4 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.

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.

GEOL2011

Mineralogy & Igneous Petrology

Staff Contact: Dr P.C. Rickwood/ A/Prof B.J. Hensen

S1 L2 T3

Prerequisite: GEOL1201

Note/s: Fieldwork of up to 4 days is a compulsory part of this subject. Students will incur personal costs.

Mineralogy. Principles of optical crystallography and the use of the 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 & Structural Geology

Staff Contact: A/Prof C.R. Ward/ A/Prof B.J. Hensen/Dr P.G. Lennox

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.

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 C.R. Ward/Prof J. Roberts

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.

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/evaporite domains. The facies concept: lateral and vertical relationships between depositional environments and associated lithofacies within developing sediment wedges. **Palaeontology.** Morphology and geological significance of invertebrates including Foraminifera, Brachiopoda, Mollusca, Coelenterata,

Arthropoda, Protochordata and Echinodermata. Introductory paleobotany, biogeography, ichnology (trace fossils) and biostratigraphy.

GEOL2041

Geological Computing

Staff Contact: Dr D.R. Cohen

S1 L2 T1

Prerequisite: GEOL1101

Introduction to the use of PC, network and VAX computer systems with emphasis on geological software. Introduction to programming in FORTRAN with statistical applications pertinent to geoscience.

GEOL2042

Geological Statistics

Staff Contact: Dr D.R. Cohen

S2 L2 T1

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

S1 L2 T1

Prerequisite: GEOL1101

Note/s: Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.

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 A.D. Albani/Mr G. McNally

S2 L2 T2

Prerequisite: GEOL1101 or GEOL1201

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 Grid. System transformations. The use of air photos for geological mapping and geomorphological evaluation of the land. Techniques and principles of multi-band photography; photo-interpretation of geological features. Relationships between geology, drainage, soil and vegetation, orebody expression, gossans, colouration halos. An introduction to remote sensing.

GEOL2072

Environmental Geology

Staff Contact: Prof G. Hocking/A/Prof A.D. Albani/

Dr J. Jankowski

S2 L2 T1

Environmental Geology. Hydrodynamics of pollutants and water quality principles. Domestic, industrial and radioactive waste disposal, deep-well injections. Geological hazards and urban planning. Environmental impacts of dams, mineral exploration, mining and impact

statement techniques. 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 P.C. Rickwood/Mr P. Atherden

S2 L2 T1

Prerequisite: GEOL1201

Geochemistry. Accuracy, precision and quality of geochemical data. Graphical display of analyses. Norms. The natural distribution of elements in terrestrial rocks. Heavy metals in unconsolidated sediments. Nature and origin of meteorites and tektites. Aqueous Geochemistry. Redox potentials in nature. Oxidation/reduction and sediment formation. Solubilities, metal transport and ore deposition. The growth of minerals from solution and the development of mineral textures. Particular aqueous geochemical systems.

GEOL3011

Mineralogical Techniques

Staff Contact: Dr P.C. Rickwood

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 B.J. Hensen

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.

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. Fabric Relationships of deformation and recrystallization*. Metamorphic petrology of Australia. Practical macroscopic and microscopic study of metamorphic suites from different tectonic regimes.

* Pressure, temperature, time-paths and Tectonic setting of metamorphism in the earth's crust.

GEOL3031**Stratigraphy & Basin Analysis***Staff Contact: Prof J. Roberts*

S1 L2 T2

Prerequisite: GEOL2031**Note/s:** Fieldwork of up to 8 days is a compulsory part of this subject. Students will incur personal costs.

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.

GEOL3052**Exploration Geophysics***Staff Contact: Mr D. Palmer*

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.

Introduction to seismic, electrical and electromagnetic methods of geophysical exploration. Data interpretation and application of these methods for mineral, petroleum, coal and groundwater exploration and engineering projects.

GEOL3072**Engineering Geology***Staff Contact: Prof G. Hocking/Mr G. McNally*

S2 L2 T1

Note/s: Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.

Rock and soil masses and their engineering behaviour. Influence of composition and fabric. Discontinuities in rocks and soils and their analysis for engineering purposes. Mechanical properties and their measurement. Stress-strain theory. Examples of Engineering Geology applications.

GEOL3082**Structural Geology***Staff Contact: Dr P.G. Lennox*

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.

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 A.C. Dunlop/ Prof G.J.S. Govett/**Dr D.R. Cohen*

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 A.C. Dunlop*

S1 L3 T2

Prerequisite: GEOL2022*Corequisite:* GEOL3011**Note/s:** Fieldwork of up to 4 days is a compulsory part of this subject. Students will incur personal costs.

Metallic Resources: Classification and origin of the ore deposits, geochemical processes, research methods. Orthomagmatic, hydrothermal, porphyry, volcanic, sedimentary, Mississippi Valley type, chromium, iron, manganese ores, residual and mechanical ores. Introduction to mineral exploration. Laboratory study of hand specimens, thin sections and polished sections of various ore types; study of selected mining areas representing various genetic types of ore. Economic Mineralogy. Nature of reflected light. Ore textures and their interpretation. Phase relations and paragenesis of ore minerals. Practical work in optical properties of ore minerals, hardness and reflectivity measurements: study of selected ores and ore minerals under the microscope including textural studies.

GEOL3102**Fossil Fuels & Non-metallic Resources***Staff Contact: A/Prof C.R. Ward*

S2 L3 T2

Prerequisites: GEOL2011 and GEOL2031**Note/s:** Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.

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. Geology of oil shale. Petroleum Geology. Geological factors critical to the occurrence of oil and natural gas. Geochemistry of hydrocarbons and formation fluids; techniques of petroleum exploration. Assessment and development of reserves. Typical petroleum occurrences in Australia and overseas. Non-metallic Minerals. Occurrences and economic use of non-metallic and industrial minerals including limestone, silica, asbestos and construction materials. 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 P.C. Rickwood/ Dr D.R. Cohen/**A/Prof G.R. Taylor/ Dr M.B. Katz*

S1 L T6

Note/s: Fieldwork of up to 7 days is a compulsory part of this subject. Students will incur personal costs.

Geochemical Techniques. Sampling strategy and methodology; preparation of samples for analysis. Modern destructive and non-destructive methods of rock and mineral analysis including spectrophotometry, AAS, ICP, DCP, XRF and electron probe microanalysis. 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 A.C. Dunlop

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; integration of geophysical methods; use of geological database and modelling systems; estimation of resources and reserves; reporting requirements, liability and ethics in geological practice. **Research and Communication:** Literature search and bibliographic indexes; preparation of theses, reports and scientific papers; preparation of maps and other illustrations; presentation of technical material in verbal form; job applications and interview requirements.

GEOL4131

Special Topics in Applied Geology

Staff Contact: Dr P.G. Lennox

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) 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 P.G. Lennox

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.

Servicing Subjects

These are applied geology subjects taught within courses offered by other faculties.

GEOL4303

Geology Honours

Staff Contact: Dr P.G. Lennox

Note/s: Restricted to program 3970/2500

Students with a double major in geology will follow the program set for Year 4 students in the Faculty of Applied Science course Applied Geology (3000).

GEOL4313

Earth and Environmental Science (Honours)

Staff Contact: A/Prof A.D. Albani

Note/s: Restricted to program 3970/2527

GEOL4323

Earth Environments (Geology)

Staff Contact: A/Prof A.D. Albani

Note/s: Advanced Science only. Restricted to program 3972/6865

GEOL5100

Geology for Civil and Environmental Engineers

Staff Contact: Dr P.G. Lennox

S1 L2 T1

Note/s: Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.

An introduction to mineralogy, petrology, structural geology, stratigraphy and geomorphology. Weathering of rocks and development of soils. The role of the geologist in civil and environmental engineering.

GEOL5110

Geology for Landscape Architecture

Staff Contact: A/Prof A.D. Albani

Minerals and rocks. Igneous, sedimentary and metamorphic rocks; their origin and their relationship with the landscape. Geological structures and their graphic representation. Interpretation of geological maps and sections.

GEOL5211

Geology for Mining Engineers 1

Staff Contact: Dr M.B. Katz

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 C.R. Ward

S1 L1.5 T.5

Note/s: Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.

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 M.B. Katz

F L2 T2

Note/s: Fieldwork of up to 1 day is a compulsory part of this subject. Students will incur personal costs.

Stratigraphy and the use of fossils. Structural Geology including stereographic projection and fracture analysis as applied to mining operations. Origin and properties of coal, oil, oil shale and natural gas. Principles of hydrogeology including the significance of groundwater in mining operations. Mineralogy of important metallic and non-metallic resources, processes of ore formation. Exploration methods.

GEOL5312

Petroleum Geology and Geophysics

Staff Contact: Dr P.G. Lennox/Mr D. Palmer

S2 L2 T1

Prerequisite: GEOL5301

Petroleum Geology: Petroleum generation, including kerogen types and maturation migration, entrapment and degradation; Sedimentary features of reservoir sequences; Structural traps, diaps 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

Staff Contact: A/Prof C.R. Ward

S1 L1.5 T.5

Prerequisite: GEOL5312

Petroleum exploration and development programs; sub-surface maps and sections; geologic characteristics of selected reservoir types: porosity characteristics and recovery effects; coal-bed methane; estimation of petroleum resources.

GEOL5410

Geology for Mineral Engineers

Staff Contact: A/Prof C.R. Ward/Dr M.B. Katz

S2 L2

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; introduction to microscope techniques.

GEOL6201

Marine Geology 1

Staff Contact: A/Prof A.D. Albani

F L1 T2

Prerequisites: GEOL1101 and GEOL1201

Note/s: Field work of 5 days is a compulsory part of the subject. Students will incur personal costs.

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/evaporite domains. The facies concept: lateral and vertical relationships between depositional environments and associated lithofacies within developing sediment wedges. Mineralogy and Petrology. Igneous and sedimentary rock types of the ocean floor and their significance.

GEOL6221

Introductory Geophysics

Staff Contact: Mr D. Palmer

S1 L2 T1

Note/s: Excluded GEOL2051. Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.

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.

GEOL6231

Coastal Monitoring Techniques

Staff Contact: A/Prof A.D. Albani

S1 L1 T2

Note/s: Field work of up to 4 days is a compulsory part of the subject. Students will incur personal costs.

General principles of surveying. Optical and electronic methods of distance and elevation measuring. Coastal position fixing. Coordinates systems and their application to coastal mapping. Map projections. Long and short term monitoring of coastal changes. Tides, their measurement and determination of tidal planes. Soundings and bathymetric surveys. Shallow water investigations for seabed and bedrock morphologies. Through its intensive practical approach, the course is designed to give each student an understanding of coastal surveying applicable to a large variety of small scale investigations, from beach to estuarine monitoring.

GEOL6311

Marine Geology 2

Staff Contact: A/Prof A.D. Albani

F L1 T2

Prerequisite: GEOL6201

Structure and properties of the clay mineral groups including the kaolinites, illites, smectites, chlorites, mixed layered and fibrous clay minerals. Techniques for identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. Geological evolution of the Australian continent. Depositional regions within and adjacent to continents, islands 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.

GEOL6321**Coastal Environmental Assessment***Staff Contact: A/Prof A.D. Albani*

S2 L1 T2

Note/s: Field work of up to 3 days is a compulsory part of the subject. Students will incur personal costs.

The physical nature of the various coastal environments: their morphology and the relationship between water masses and the sedimentary and benthic characteristics of the bottom. Sampling techniques, analytical methodology and statistical data evaluation. Environmental assessment of Australia and overseas areas. An important aspect of the course is its practical approach: from data gathering, data evaluation and environmental assessment report writing. Practical work in the course involves each student as an active member of a project team.

GEOL6330**Exploration Geophysics***Staff Contact: Mr D. Palmer*

S2 L2 T1

Note/s: Excluded GEOL3052

Geophysics of ocean basins and offshore areas and the techniques of their study. Seismic refraction, reflection and computational methods, instrumentation of seismic and acoustic sources, recording systems and signal processing. Geological and physical interpretation of results. Practical work on instrumentation, recording and interpretation of field data.

GEOL6331**Geochemistry***Staff Contact: Dr P.C. Rickwood/Mr P. Atherden*

S2 L2 T1

Prerequisite: GEOL1201

Note/s: Excluded GEOL2092

Geochemistry. Accuracy, precision and quality of geochemical data. Graphical display of analyses. Norms. The natural distribution of elements in terrestrial rocks. Heavy metals in unconsolidated sediments. Nature and origin of meteorites and tektites. Aqueous Geochemistry. Redox potentials in nature. Oxidation/reduction and sediment formation. Solubilities, metal transport and ore deposition. The growth of minerals from solution and the development of mineral textures. Particular aqueous geochemical systems.

GEOL7223**Surficial Constituents***Staff Contact: A/Prof C.R. Ward*

F L3 T2

Prerequisite: GEOL1101 or GEOL1201

Exclusions: GEOL2011, GEOL2022, GEOL3102

Mineralogy. Principles of optical crystallography and the use of transmitted light polarising microscope. Chemical and physical properties of rock-forming minerals. Mineral identification. Sedimentary petrology. The influence of transportation, deposition and diagenesis on the composition, texture and structure of detrital sedimentary evaporites; ferruginous and siliceous deposits. 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.

GEOL7233**Processes in Environmental Geology***Staff Contact: A/Prof A.D. Albani*

F L2 T1

Prerequisites: GEOL1101 or GEOL1201

Exclusions: GEOL2031 and GEOL2072

Flow regimes and sedimentary structures. Depositional processes and sedimentation in modern and ancient environments. The facies concept. Pollutants and water quality principles, waste disposal. Geological hazards and urban planning. Assessment and impact of dams and mining. Exploration for groundwater and monitoring groundwater resources. Sedimentary populations and their analysis. Coastal assessment and monitoring.

GEOL7321**Geology for Geomorphologists and Pedologists***Staff Contact: A/Prof C.R. Ward*

S1 L1 T1 S2 L2 T2

Prerequisites: GEOL1201

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; analyses 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.

GEOL7323**Environmental Processes***Staff Contact: Dr P.C. Rickwood/Mr P.R. Atherden*

F L2 T1

Prerequisite: GEOL7223

Exclusions: GEOL2092, GEOL3011

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. Accuracy, precision, quality and display of geochemical data. Norms. Element distribution in terrestrial rocks. Heavy metals in unconsolidated sediments. Radiogenic dating. Redox potentials. Solubilities, metal transport and ore deposition. Mineral textures and the growth of minerals from solution.

GEOL7333**Environmental Statistical Methods***Staff Contact: Dr D.R. Cohen*

F L2 T1

Prerequisites: GEOL1101 or GEOL1201

Exclusions: GEOL2041, GEOL2042

Introduction to the use of PC, network and VAX computer systems with emphasis on geological software. Introduction to programming in FORTRAN with statistical applications pertinent to geoscience. Sampling of geological materials; stochastic geological processes. Introduction to geostatistics, population characterisation and splitting, ANOVA methods, regression analysis, EDA,

Markov chains. Analysis of oriented data and processing of spatial geological data.

GEOL8220

Sedimentology

Staff Contact: A/Prof C.R. Ward

S1 L1 T1

Prerequisite: GEOL1201

Note/s: Excluded GEOL2031

As for Sedimentology in GEOL2031 Sedimentology and Palaeontology.

GEOL8320

Gravity and Magnetic Methods

Staff Contact: Mr D. Palmer

S1 L2 T1

Prerequisites: PHYS1002 and MATH1032.

Note/s: Available only in program 2503. Field work of one day is a compulsory part of the subject. Students will incur personal costs. It is desirable that students taking this unit have a background to geology

Fundamental principles. Field procedures and instruments. Reduction of field data. Regional and residual effects of sources of simple geometrical shapes and generalised two and three-dimensional distributions.

GEOL8330

Seismic Methods

Staff Contact: Mr D. Palmer

S1 L2 T1

Prerequisites: PHYS1002 and MATH1032.

Note/s: Available only in program 2503. It is desirable that students taking this unit have a background in geology. Field work of one day is a compulsory part of the subject. Students will incur personal costs.

Seismic waves. Physical/engineering properties of geological materials. Ray theory in seismic refraction and reflection methods. Instrumentation. Data acquisition and processing. Depth and velocity analysis. Geophysical and geological interpretation. Case history studies.

GEOL8340

Electrical Methods

Staff Contact: Mr D. Palmer

S1 L2 T1

Prerequisites: PHYS1002 and MATH1032.

Note/s: Available only in program 2503. It is desirable that students taking this unit have a background in geology. Field work of one day is a compulsory part of the subject. Students will incur personal costs.

Introductory theory and field practice of resistivity, self-potential, induced polarisation and airborne and ground electromagnetic methods. Geological interpretation of field data. Geophysical logging.

GEOL8350

Geological Applications

Staff Contact: A/Prof C.R. Ward/Dr P.G. Lennox

S1 L1 T1

Prerequisite: GEOL1201

Note/s: A subject of ten weeks duration. Available only in program 2503. Field work of one day is a compulsory part of the subject. Students will incur personal costs.

Structural Geology: Elements of structural geology, stereographic projection and fracture analysis. Geology of Fuels: Origin of coal, oil and natural gas; stratigraphic and

structural consideration of oil and coalfields. Hydrogeology: Principles of hydrogeology; transmission of groundwater in rocks and soils.

GEOL8360

Geophysical and Geological Applications

Staff Contact: Mr D. Palmer

S2 L1 T2

Prerequisite: GEOL1201

Note/s: Excluded GEOL6330. Available only in program 2503.

Geological interpretation of Geophysical data. Seismic stratigraphy. Coal-seam geometry from high resolution seismic and in-seam data. Geology of Ore Deposits. Mineralogy of industrially important metallic and non-metallic minerals. Theories of ore formation including secondary enrichment processes.

GEOL9110

Hydro and Environmental Geology

Staff Contact: Prof G. Hocking/Dr J. Jankowski/

Dr I. Acworth

S2 L2 T1

Prerequisite: GEOL5100

Note/s: Field work of up to two days is a compulsory part of this subject. Students will incur personal costs.

Hydraulics of groundwater in fractured rock, Hydrodynamic dispersion of contaminants in porous and fractured media, sources of contaminants in the groundwater system, monitoring and sampling of contaminants in groundwater, groundwater quality and environmental standards. Environmental Geology: Domestic, industrial and radioactive waste disposal, deep well injections. Geological hazards and urban planning. Impact of dams, mineral exploration, mining and impact statement techniques. Land use conflicts. Coastal Geology: Properties of sedimentary populations. Sampling practices. Geological significance of sediment parameters. The shoreline's processes, littoral and longshore drifts and net sand movement.

GEOL9120

Groundwater Contaminant Transport

Staff Contact: Dr J. Jankowski

S1 L2 T1

Prerequisites: GEOL9110

Hydrogeochemistry: Chemical composition of natural and contaminated groundwater, inorganic and organic chemical principles. Application of chemical thermodynamics. Mineral dissolution and precipitation. Non-equilibrium approaches. Chemical classification of groundwater and hydrochemical facies in aquifers. Geochemical evolution of groundwater. Application of stable and radioactive isotopes. Computer models. Case studies. Interactions of solid, liquid and gaseous phases. Salt sieving and brine development. Chemical and microbiological reactions in and near boreholes and relevance to borehole performance, deterioration, rehabilitation. Chemical dispersion theories for contaminants, hydrochemical modelling for inorganic and organic contaminant plumes. Practical field measurement and laboratory analysis for determination of hydrochemical parameters, adsorption, desorption, K_d , dispersivity. Groundwater Modelling: Types of groundwater models and their physical bases for porous and fractured rock aquifers. Modelling low permeability materials. Analogue, analytical and numerical model forms. Stochastic modelling and

characterisation of variability. Modelling multiphase, immiscible fluids, and regional groundwater flow. Applications of modelling to bore-field management, saltwater intrusion, mine dewatering, waste disposal and contaminant transport.

Department of Mining Engineering

APSE0002

Social Issues in Applied Science

Staff Contact: Dr A.K. Bhattacharyya

S1

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.

MINE0010

Applied Mechanics

Staff Contact: Dr J.O. Watson

S1 L2 T1

Statics: definition of force; free body diagrams; static equilibrium of rigid body; statical equivalence of systems of forces; centre of mass, centroid, centre of pressure; friction: clutch, screwjack, belt drive. Kinematics: rectilinear and angular motion; motion in a plane; relative displacement, velocity and acceleration; gear trains and linkages. Dynamics: equations of motion for particle and rigid body; work and energy; impulse, momentum and impact.

MINE0110

Stress Analysis 1

Staff Contact: Dr J.O. Watson

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; isotropic elasticity.

MINE0120

Stress Analysis 2

Staff Contact: Dr J.O. Watson

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.

MINE0210

Introduction to Mining Engineering

Staff Contact: Professor F.F. Roxborough

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 beneficiation. Relevance of the basic science and engineering disciplines to the mining industry.

MINE0410

Technical Communication

Staff Contact: Dr C.R. Daly

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 C.R. Daly

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.

MINE1131

Mining of Metalliferous Deposits

Staff Contact: Mr D Panich

S1 L3

Prerequisites: MINE0210, MINE1420, GEOL5211

Geology, mineralogy and physical characteristics of a mineral deposit. Mineralisation inventory: maps and sections. Determination of reserves. Choice between surface and underground mining: selection criteria. Mining methods in surface and underground operations. Mining sequence. Production planning and scheduling. Equipment selection: systems approach; types of equipment; selection 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: Dr A.K. Bhattacharyya

S1 L3

Prerequisites: MINE0210, MINE1420, GEOL5211

Geological factors, physical and mechanical characteristics of the seam, roof and floor. Maps and sections.

Determination of reserves. Choice between surface and underground mining methods: selection criteria. Mining methods for surface and underground operations. Impact of surface constraints. Production planning and scheduling. Mining geometrics. Stability and support. Equipment selection: systems approach; types of equipment; selection of type, capacity and number. Mining and ancillary operations. Productivity and operating costs. Health and safety. Communications and control. Rehabilitation.

MINE1140

Geotechnical Engineering

Staff Contact: Dr A.K. Bhattacharyya

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.

MINE1231

Rock Mechanics

Staff Contact: Dr V.S. Vutukuri

S2 L2 T2

Prerequisites: MATH1032, 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 A.K. Bhattacharyya

S2 L1 T1

Prerequisites: MATH1032, 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 A.C. Partridge

F L1 T.5

Prerequisites: MINE0010, MINE0110, PHYS1002, MATH1032

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

Staff Contact: Dr V.S. Vutukuri

S2 L1

Corequisite: MINE1320

Engineering hydrology, sources of mine water, forecasting water inflows, drainage and dewatering, pumps and pumping.

MINE1330

Bulk Materials Handling and Transport

Staff Contact: A/Prof G.C. Sen

S2 L1.5 T.5

Transport systems for minerals, waste and supplies. Descriptions and power requirements for: conveyors (belt and chain), rope haulage systems, free steered vehicles and locomotive haulage systems. Descriptions and pressure loss calculations for hydraulic and pneumatic transport systems. Mine winding systems for shafts: mechanics for hoisting; winding cycle diagrams; power requirements. Safety aspects and maintenance programs for haulage and winding systems.

MINE1420

Elements of Mining

Staff Contact: Mr D. Panich

S1 L1

Prerequisite: MINE0210

Note/s: Visits to mines and related undertakings are a requirement of this subject.

Exploration. Development of mines, infrastructure requirements; environmental assessment. Ore body parameters for surface and underground mines; stratified and non-stratified deposits; mine layout for surface and underground operations; underground access; introduction of techniques of rock breakage and support for coal and metal mines; processing of minerals; disposal of overburden and rejects rehabilitation.

MINE1530

Power Supply in Mines

Staff Contact: Dr C.R. Daly

S1 L1 T1

Prerequisites: MINE0310, MINE1320, PHYS2920, ELEC0802

Electric power distribution, mine cables, switchgear. Flame-proofing and intrinsic safety, fault protection, risk analysis. Oil hydraulic power. Components and circuits. Pumps, motors, valves.

MINE1630

Excavation Engineering (Blasting)

Staff Contact: A/Prof G.C. Sen

S1 L2

Percussive, rotary and hydraulic rock drilling equipment: applications and operating principles, maintenance. Drilling

methods: in-the-hole hammer, diamond core, overburden, Odex. Theories of rock fragmentation by blasting. Types of explosives and their properties. Various initiation systems. Blasting accessories and their applications. Blast design in various underground and surface mining operations. Blasting hazards and precautionary measures. Protection of structures against blast induced ground vibrations and airblast. Alternatives to conventional explosives.

MINE1631**Excavation Engineering (Machine Mining)**

Staff Contact: Prof F.F. Roxborough

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: Dr C.R. Daly

S2 L2

An appreciation of the laws relating to coal and metal mining practice and to safety and health in mines.

MINE1830**Mine Ventilation and Environment**

Staff Contact: Dr V.S. Vutukuri

S2 L2 T2

Prerequisites: MINE0210, 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. Ventilation planning: airflow requirements based on pollutant gas, airborne dust and heat.

Laboratory experiments.

MINE1930**Industrial Training**

Staff Contact: Dr A.C. Partridge

S0 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 G.C. Sen

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

S1 L2

Prerequisites: MINE1131, MINE1132

Commodities. Supply and demand. business cycles. Exchange rates. Metal markets and hedging. Project financing including: Joint Ventures. Types of capital. Reporting by companies. Feasibility studies and mine evaluation. Determination of cut-off grades. Smelter returns. Marketing and sales contracts.

MINE2142**Mine Planning and Design**

Staff Contact: Mr D. Panich

F L1 T2

Prerequisites: MINE1131, MINE1132

Corequisite: MINE2141

Interpretation of exploration data. Sampling. Estimation of resource and reserves: traditional and geostatistical methods. Mine planning parameters. Mine design. Equipment selection. Productivity. Capital and operating costs. Mine design project.

MINE2240**Mining Management**

Staff Contact: Dr C.R. Daly

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 V.S. Vutukuri

S2 L1.5 T1.5

Prerequisites: MINE 0210, MINE1420

Outburst in coal mines: occurrence, prediction and control. Mine explosions and their control: methane, coal dust, sulphide dust. Mine fires and their control: open fires, spontaneous combustion of coal and sulphide ores in underground mines, sealing off fires underground, fire fighting, recovery of sealed-off areas. Water in mines: inundations, intrusions, 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

S1 L2

Overview of risk management: quantifying risk and acceptable risk. Statistical methods for identifying potential for loss. Hazard and risk identification methodologies. Causes of accidents. Methods of quantifying risk: consequence modelling, fault trees, event trees. Methods of controlling risk and living with residual risk.

MINE3140

Computational Methods in Geomechanics

Staff Contact: Dr J.O Watson

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.

MINE3240

Operations Research

Staff Contact: Dr C.R. Daly

S1 L1 T1

Linear programming, decision analysis, queuing theory, simulation, forecasting, reliability, replacement, inventory and production, dynamic programming. Project management, use of project management software.

MINE4140

Minerals Industry Project

Staff Contact: Dr A.C. Partridge

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.

MINE4240

Industrial and Research Seminars

Staff Contact: Mr D. Panich

F L1

A series of seminars presented by invited speakers from within the university, other research establishments and selected industrial operations, covering special topics of current interest.

MINE4540

The Mining Engineering Profession in Society

Staff Contact: Dr J.O. Watson

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.

MINE7342

Minerals Engineering Processes

Staff Contact: Dr A.C. Partridge

F L1 T1

Objectives of mineral processing and coal preparation. Mine-mill interface. Properties of minerals and ores. Sampling and evaluation. Comminution: fracture, liberation, size criteria, energy-size relationships. Crushing and grinding. Screening and classifying. Concentration processes: density and other physical methods. Dissolution processes. Interfacial phenomena. Flotation. Liquid-solid separation: flocculation, thickening, filtration. Washability curves. Partition curves. Material balances. Performance prediction. Laboratory exercises.

MINE7440

Mineral Process Technology

Staff Contact: Dr A.C. Partridge

S1 L1.5 T.5

Feed characterisation: Float-sink separation, release analysis, tree procedure. Vector representation for samples: Mayer curves and release curves. Physics and chemistry of surfaces. Measurement of surface properties. On-stream and laboratory analyses and measurements. Laboratory and pilot testing. Flow-sheet design. Equipment selection and plant layout. Materials handling, storage and blending. Rejects and tailings disposal. Sampling: sampling theory, sources of error in sampling, design of sampling plants. Process optimisation and control. Incremental ash theory. Process modelling and simulation. Laboratory exercises.

Graduate Study

Course Outlines

Department of Applied Geology

Master of Applied Science courses 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.

Courses currently offered are in the fields of Engineering Geology, Hydrogeology, Environmental Geology, and Geological Data Processing.

8020 Engineering Geology/Hydrogeology/Environmental Geology Course

Master of Applied Science MAppSc

The course consists of a Project (Group A) and from five to eight subjects chosen from Group B, of which five are core subjects of the course. The total credit point requirement of the course is 30, of which the project could account for 6, 9 or 15 credit points. The 6 and 9 credit point project is aimed at those students who prefer a higher content of teaching in their MAppSc course, or who find that their interests are not fully covered within the core subjects.

The five core subjects are all taught in the first session. Up to three additional subjects, completed by full-time attendance during the second session, or part-time, or as an external student, may be credited towards the degree, with a consequent reduction in the project requirements. The project normally consists of field and laboratory work, and is related to the students major interests. Students must consult the Course Director for approval of the project topic. Students undertaking fieldwork may incur personal costs.

C

Group A		
GEOL9444	Project (Engineering Geology)	6
GEOL9454	Project (Engineering Geology)	9
GEOL9464	Project (Engineering Geology)	15

Group B

Core Subjects (3 credit points)

CIVL9788	Site Investigation
GEOL9011	Hydrogeology G
GEOL9030	Geological Engineering
GEOL9040	Fundamentals of Geomechanics
GEOL9060	Environmental Geology

Elective Subjects (3 credit points)

CIVL9790	Stability of Slopes
GEOL0110	Geological Remote Sensing
GEOL9031	Engineering Geology of Surficial Deposits
GEOL9032	Soil and Rock Construction Materials
GEOL9033	Terrain Evaluation
GEOL9070	Engineering Geophysics

An additional requirement for the award of the MAppSc Engineering Geology is the satisfactory completion of laboratory and field practical sessions, attendance on field excursions, and contributions to tutorials and seminars.

8094 Geological Data Processing

Master of Applied Science MAppSci

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 30 credits including either a 6 or 12 credit project. Alternative subjects may be substituted in the published program at the discretion of the Head of the Department.

Core Subjects

These subjects are compulsory:

- GEOL0300 Computing and Statistics for Geologists*
 GEOL0310 Image Processing of Spatial Data Sets
 GEOL0320 Geostatistical Ore Reserve Estimation

Totalling 9 credit points

and either

- GEOL0304 Data Processing Project 1 6 credit points or
 GEOL0314 Data Processing Project 2 12 credit points

Electives

Between 9 and 15 credits of elective subjects may be selected to make a total of 30 credits.

Technical (3 credit points)

- 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

Business Management (3 credit points)

- 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.*

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

UNSW Groundwater Centre

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.

8021**Hydrogeology and Groundwater Management Graduate Course****Master of Applied Science
MAppSc**

For the Master of Applied Science in Groundwater Management and Hydrogeology candidates are required to complete 30 credits, 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.

Core Subjects (3 credit points)

GEOL9010	Groundwater Environments
GEOL9051	Hydrogeochemistry
CIVL9880	Groundwater Modelling
CIVL9861	Environmental and Engineering Geophysics
CIVL9875	Hydrological Processes

Elective Subjects (3 credit points)

GEOL9012	Contaminant Hydrogeology (short course format)
GEOL9052	Advanced Hydrogeochemistry (short course format)
GEOL9100	Remote Sensing of Groundwater Resources
CIVL9799	Environmental Geomechanics
KCME1110	Geographic Information Systems in Applied Geology

Project

GEOL9124	Groundwater Project 9 credit points
GEOL9144	Groundwater Research Project 12 credit points

Waste Management Graduate Courses**8612 (Internal)****8614 (External)****Master of Engineering Science****MEngSc**

The Master of Engineering Science degree is undertaken through the School of Civil Engineering in the Faculty of Engineering. Full details are available in the Faculty of Engineering handbook.

5459 (Internal)**5498 (External)****Graduate Diploma****Grad Dip**

The Graduate Diploma is undertaken through the School of Civil Engineering in the Faculty of Engineering.

Alternative Graduate Programs

Alternative Graduate Programs in association with the Department of Applied Geology are available in the following areas:

School of Geography

5026 Graduate Diploma in Remote Sensing (GradDip)
8026 Remote Sensing Graduate Course (MAppSc)
8045 Environmental Studies Graduate Course (MEnvStudies)

Faculty of Engineering

5495 Graduate Diploma in Remote Sensing (GradDip)
8640 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.

The Master of Applied Science program has been designed for completion of its 36 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 36 credit points must still be attained.

Entry for Four Year Graduates - Non-Mining**Core Subjects**

MINE0130	Principles of Mining	C
MINE1224	Mining Engineering Technology	2
MINE1524	Mining Conservation	6
MINE3114	Mineral Beneficiation	3
and one of		3
MINE5064	Minor Project	6
MINE5124	Project	12
MINE5184	Major Project	18

Entry for Graduates in Mining Engineering or from Course 5040**Core Subjects**

MINE5324	Principles of Mining Engineering (2)	6
MINE1524	Mining Conservation (1)	3
and either		
MINE3224	Mineral Beneficiation Technology or	
MINE4424	Mineral Industry Analysis	6
and one of		
MINE5064	Minor Project	6
MINE5124	Project	12
MINE5184	Major Project	18
MINE3654	Minerals Engineering Project	9

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

(2 credit points)

MINE5655	Rock Slope Stability
MINE5755	Subsidence Engineering
MINE9174	Fire and Explosion

(3 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

(6 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 9 credit points of undergraduate subjects may be substituted for the topics shown where appropriate to the skills of the student concerned.

Full-time Program

		C
MINE0130	Principles of Mining	2
MINE1114	Mining Engineering	6
MINE1224	Mining Engineering Technology	6
or		
MINE3324	Mineral Beneficiation Technology	6
MINE1324	Mining Laboratory and Project	8
or		
MINE3324	Mineral Engineering Laboratory and Project	8
MINE2340	Mineral Economics	
MINE3114	Mineral Beneficiation	
MINE7140	Mineralogical Assessment	1
MINE7341	Mineral Process Engineering	2
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 6 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

The Key Centre is a joint initiative of the Universities of New South Wales and Wollongong. Funded by the Department of Employment, Education and Training. The purpose of the Key Centre for Mines is to provide a full range of educational and research services to the minerals industries.

Particular emphasis is being placed on continuing education, distance learning 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.

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 3 credits 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 9 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 industrybased 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 (3 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
KCME1302	Mine Ventilation and Environment
KCME2101	Strata Control
KCME2104	Application of Computers in the Mining Industry
KCME2105	Geostatistics and Ore Body Modelling
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

Business Management Modules (3 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 Evaluation and Project Assessment
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
12 credit points (8057 only)

KCME1400 Mining Management Project
9 credit point (5057 only)

Unless otherwise stated all modules are of 3 credit 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.

Department of Applied Geology

GEOL9010

Groundwater Environments

Staff Contact: Dr J. Jankowski/Dr R.I. Acworth
C3 S1

Physical properties of groundwater. Darcy flow; hydraulic conductivity - field and laboratory methods; storage and transmissivity; flow nets - local and regional flow systems. Drilling methods; well design and completion; well development; pumping tests and interpretation. Study of the detailed occurrence; methods of development and environmental problems associated with groundwater, in 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.

GEOL9011

Hydrogeology

Staff Contact: Dr J. Jankowski/Dr R.I. Acworth
C3 S1 L1.5 T1.5

Physical properties of groundwater. Darcy flow; hydraulic conductivity - field and laboratory tests. Storage and transmissivity; flow nets; local and regional flow systems. Drilling methods well design and completion; well development; pumping tests and interpretation. Groundwater chemistry. Introduction to contamination. Geophysical methods for groundwater investigation. Groundwater modelling - finite difference methods. Introduction to remote sensing for groundwater.

GEOL9012

Contaminant Hydrogeology

Staff Contact: Dr J. Jankowski/Dr R.I. Acworth
C3 S2

Sources of groundwater contamination; groundwater quality investigation; groundwater sampling procedures at contaminated sites; water quality criteria and review of Australian legislation. Hydrochemical modelling for inorganic and organic contaminant plumes; analytical and numerical approaches to modelling contaminant transport, dispersion, diffusion, adsorption and desorption processes. Groundwater restoration; site remediation. Occupational health and safety issues. Case studies in contaminant hydrogeology; practical field techniques; drilling, probing, piezometer installation, pumping equipment and sampling procedures, slug and tracer tests.

GEOL9030

Geological Engineering

Staff Contact: Mr G. McNally
C3 S1 L1.5 T1.5

Geomechanical properties of intact rock. Geomechanical properties of discontinuities and rock masses. Weathering processes and geotechnical consequences. Engineering classification of rock masses. Excavation rippability, mechanical excavation of tunnels, surface and tunnel blasting. Rock support for shallow underground structures. Dam engineering, dam size geology, embankment zoning, foundation treatment and grouting, materials selection and specification, dispersive soils and filter design. Foundations on rock, buildings, temporary support of open excavations.

GEOL9031

Engineering Geology of Surficial Materials

Staff Contact: Mr G. McNally
C3 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 G. McNally
C3 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 beneficiation; environmental considerations, blast monitoring and quarry reclamation; waste and synthetic materials.

GEOL9033

Terrain Evaluation

Staff Contact: Mr G. McNally
C3 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: Prof G. Hocking
C3 S1 L1.5 T1.5

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/Dr R.I. Acworth
C3 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/Dr R.I. Acworth
C3 S2

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 G. McNally
C3 S1 L1.5 T1.5

Geological hazards: seismic risk, landslides, subsidence, floods, erosion, volcanic eruptions, discrete and continuous hazards, event return time. Geological resources and their management: types of resources, use and potential environmental conflict, resource economics and policy formulation. Waste disposal and the mineral industry, reclamation and rehabilitation of land used for extractive purposes. Swamp drainage. Geology and urban planning: map preparation, multiple land use principle, aesthetic criteria for landscape evaluation. Environmental impact of dams, roads, explorative and extractive stages of mining, impact statement techniques, case studies. Communication of geological information to technical and non technical people. Geological legislation for water resources and waste disposal.

GEOL9070

Engineering Geophysics

Staff Contact: Mr D. Palmer
C3 S1 L2 T1

Note/s: Short field tutorials are included as part of this subject. Students will incur personal costs.

Shallow seismic refraction: elastic theory, sources and equipment. Determination of fracture index, rippability. Applications to damsites, highways, depth of weathering, material quality. Seismic reflection. Sparker and boomer profiling, side scan sonar with application to coastal harbours, sewer outfalls. Electrical methods, direct current geo-electric theory, resistivity sounding and profiling with applications to determination to bedrock depth, location of water table, clay-filled dykes, shear zones. Magnetic, electromagnetic and gravity methods as applied to engineering problems. Geophysical well logging: resistivity, self potential, gamma ray and sonic logs applied to determination of rock properties and location of clay-filled joints.

GEOL9100

Remote Sensing of Groundwater Resources

Staff Contact: Applied Geology Office
C3 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.

GEOL9124

Groundwater Project

Staff Contact: Dr R.I. Acworth
C9 S2

Study of similar content to GEOL9144 but at a smaller scale.

GEOL9144

Groundwater Research Project

Staff Contact: Dr R.I. Acworth
C12 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 G. McNally
C6

Study of similar content to GEOL9464 but at a much smaller scale.

GEOL9454

Project in Engineering Geology

Staff Contact: Mr G. McNally
C9

Study of similar content to GEOL9464 but at a smaller scale.

GEOL9464**Project in Engineering Geology***Staff Contact: Mr G. McNally*

C15

Note/s: students undertaking field work may incur personal costs

The project is a research investigation consisting of field and laboratory work in any of the disciplines. Engineering Geology, Environmental Geology or Hydrogeology.

GEOL0110**Geological Remote Sensing***Staff Contact: A/Prof G.R. Taylor*

C3 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: Key Centre for Mines***Note/s:** Restricted to program 8026**GEOL0300****Computing and Statistics for Geologists***Staff Contact: Dr D.R. Cohen*

C3 SS L2 T1

Computer hardware for geological data processing; peripheral devices; operating systems; VAX VMS, IBM VM/XA, MS DOS, UNIX; programming in FORTRAN and C; statistics for geologists; data base packages and macros.

GEOL0310**Image Processing of Spatial Data Sets***Staff Contact: A/Prof G.R. Taylor*

C3 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.

GEOL0320**Geostatistical Ore Reserve Estimation***Staff Contact: Ms S. Border*

C3 SS L2 T1

Geological data bases, digital core logging. Regionalised variables; definition of the variogram, variogram modelling; volume-variance relationships; geostatistical simulation. The use of commercial ore reserve and mine planning packages.

GEOL0330**Conceptual Models for Exploration Geology***Staff Contact: Dr A.C. Dunlop*

C3 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*

C3 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 D.R. Cohen/Dr A.C. Dunlop*

C3 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 classification of geochemical populations. Spatial filtering and definition of geochemical anomalies and regional distribution patterns of elements. Introduction to robust statistical methods. New developments in geochemical data processing.

GEOL0360**Remote Sensing Applications in Geoscience***Staff Contact: A/Prof G.R. Taylor*

C3 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*

C3 SS L2 T1

This subject is designed to give geoscientists an overview of geophysical methods. The following methods are discussed in terms of physical principles, applications, data acquisition and interpretation methodology: electrical resistivity, induced polarisation, continuous wave electromagnetics, transient electromagnetics, seismic refraction, seismic reflection, gravity, magnetics and radiometrics.

GEOL0380**Electrical Methods in Geophysical Exploration***Staff Contact: Mr D. Palmer*

C3 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: Key Centre for Mines

C3 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.

GEOL0304

Data Processing Project 1

Staff Contact: A/Prof G.R. Taylor

C6 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.

GEOL0314

Data Processing Project 2

Staff Contact: A/Prof G.R. Taylor

C12 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.

GEOL0004

Special Program Applied Geology

Staff Contact: Dr A.C. Dunlop / Mr G. McNally

Note/s: For programs 8020, 8021 and 8094

GEOL0005

Research Thesis Applied Geology Full-time

Staff Contact: Dr A.C. Dunlop

Note/s: For programs 1000 and 2000

GEOL0006

Research Thesis Applied Geology Part-time

Staff Contact: Dr A.C. Dunlop

Note/s: For programs 1000 and 2000

Department of Mining Engineering

Generally these subjects are of three hours' duration per week or multiples of that time.

MINE0014

Exploration Drilling

Staff Contact: School Office

C3 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.

MINE1114

Mining Engineering

Staff Contact: Dr V.S. Vutukuri

C6 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. Nonentry methods, in situ mining. Offshore mining methods. Rock mechanics, mechanical behaviour of rocks. The Mining Acts.

MINE1224

Mining Engineering Technology

Staff Contact: Dr V.S. Vutukuri

C6 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 minimize damage.

MINE1324

Mining Engineering Laboratory

Staff Contact: Dr V.S. Vutukuri

C8 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.

MINE1514**Ground Control and Excavation Engineering**

Staff Contact: Dr V.S. Vutukuri
C3 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, stabilizing 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. Rockbreaking 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 V.S. Vutukuri
C3 S1 or S2 L2 T2

The reclamation of excavated land; integration with operational stages of mining. Mining cycles of alluvial, strip, and open cuts, land clearing, stabilizing the mined area, socioeconomic aspects of mining, rehabilitation costs, government regulations. Examination and evaluation of a current operation.

MINE1534**Environmental Conditions in Mines**

Staff Contact: Dr V.S. Vutukuri
C3 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 V.S. Vutukuri
C3 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.

MINE3114**Mineral Beneficiation**

Staff Contact: Dr V.S. Vutukuri
C3 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.

MINE3224**Mineral Beneficiation Technology**

Staff Contact: Dr A.C. Partridge
C8 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 utilization. 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.

MINE3324**Mineral Engineering Laboratory**

Staff Contact: School Office
C6 S1 or S2 HPW3

Prerequisite: MINE3114 or equivalent

Laboratory investigations may be selected from the following according to availability and specialization: metalliferous ore concentration; coal preparation; beneficiation of nonmetallics; processing of mineral fluids.

MINE3514**Mineral Beneficiation Plant Design**

Staff Contact: Dr A.C. Partridge
C3 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 V.S. Vutukuri
C6 S1 L3 T4

1. Principles of mineral deposition. Constitution of coal. Fuel technology. Coke making. Principles of extractive metallurgy. Beneficiation and utilization 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 A.C. Partridge
C6 S1 L4 T4

1. *Comminution*. Fracture. Liberation. Energysize 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 utilization including mine fill, reclamation. Pollution control.

MINE3634

Minerals Engineering Laboratory

Staff Contact: Dr A.C. Partridge
C3 S1 T3

A series of laboratory investigations relating to material covered in subjects MINE3614 and MINE3624

MINE3644

Minerals Engineering 3

Staff Contact: Dr A.C. Partridge
C6 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 organization. Communications and consultation. Management structure and organization. Marketing. Contracts and smelter schedules. Maintenance planning. Accounting and budget control. Purchasing and stores policies.

MINE3654

Minerals Engineering Project

Staff Contact: Dr A.C. Partridge
C9 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.

MINE4424

Mineral Industry Analysis

Staff Contact: Dr V.S. Vutukuri
C3 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.

MINE4055

Numerical Methods in Geomechanics

Staff Contact: Dr J.D. Watson
C3 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 postprocessing, 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.

MINE4155

Stability of Slopes

Staff Contact: Dr A.K. Bhattacharyya
C3 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.

MINE4555

Mining Geomechanics Project

Staff Contact: Dr J.O. Watson

C12 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 V.S. Vutukuri

C6 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 V.S. Vutukuri

C12 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 V.S. Vutukuri

C3 S1 or S2 HPW3

Field measurement of rock mass properties. Controlled postfailure strength and deformation properties of rock. Data collection and analysis. *In situ* stress measurement. Prediction of premining 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 V.S. Vutukuri

C18 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 V.S. Vutukuri

C3 S1 or S2 HPW3

Dislocations, stress changes and energy changes in the rock mass around underground excavations. Design of selfsupporting, 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 V.S. Vutukuri

C6 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: A/Prof E.G. Thomas

C3 S1 or S2 HPW3

Fill properties and their assessment. Fill preparation, placement and dewatering. Field sampling and in situ testing. Mining methods employing fill. Pozzolan 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 F. Roxborough

C3 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 G.C. Sen

C3 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 A.K. Bhattacharyya*

C2 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 A.K. Bhattacharyya*

C2 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.

MINE9174**Fire and Explosion***Staff Contact: Dr V.S. Vutukuri*

C2 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 V.S. Vutukuri*

C3 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 InE 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 V.S. Vutukuri*

C3 S1 or S2 HPW3

Field measurement of rock mass properties. Controlled postfailure strength and deformation properties of rock. Data collection and analysis of rock mass and support response. In situ stress measurement. Prediction of pre and postmining 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.

Key Centre for Mines**KCME1102****Mine Safety Management***Staff Contact: Prof J. Cross*

C3

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*

C3

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: Centre Office*

C3

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: Centre Office*

C3

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 D. Cohen*

C3

Computer hardware for geological data processing; peripheral devices; operating systems; VAXVMS, IBM, VM/XA, MS DOS, UNIX; programming in Fortran and C; statistics for geologists and mining engineers; data base packages and macros.

KCME1108**Applied Structural Geology***Staff Contact: Dr P.G. Lennox*

C3

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.

KCME1300**Mining Management Project***Staff Contact: A/Prof G.R. Taylor*

C12

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 V.S. Vutukuri*

C3

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: A/Prof G.R. Taylor*

C9

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: Prof R. Singh*

C3

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: Dr E. Baafi*

C3

Geostatistical ore reserve estimation on a personal computer; computerised openpit 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: Ms S. Border*

C3

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 ore waste selection; geotechnics and the environment.

KCME2107**Mine Water Origin, Inflow, Prediction and Control***Staff Contact: Centre Office*

C3

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: Centre Office***C3**

Coal characterisation, principles of separation, materials handling, sampling - theory, sampling- equipment and practice, screening and comminution, 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: Centre Office***C3**

Note/s: May be offered by correspondence.

The course is delivered by correspondence and 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: Centre Office***C3**

Note/s: May be offered by correspondence.

The course is delivered by correspondence and 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: Centre Office***C3**

Note/s: May be offered by correspondence.

The course is delivered by correspondence and 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: Centre Office***C3**

Note/s: May be offered by correspondence.

The course is delivered by correspondence and 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: Centre Office***C3**

Note/s: May be offered by correspondence.

The course is delivered by correspondence and 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: Centre Office***C3**

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: Centre Office***C2**

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: Centre Office***C3**

Geological hazards: seismic risk, landslides, subsidence, floods, erosion, volcanic eruptions, discrete and continuous hazards, event return time. Geological resources and their management: types of resources, use and potential environmental conflict, resource economics and policy formulation. Waste disposal and the mineral industry, reclamation and rehabilitation of land used for extractive purposes. Swamp drainage. Geology and urban planning: map preparation, multiple land use principle, aesthetic criteria for landscape evaluation. Environmental impact of dams, roads, explorative 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***C3**

Marketing as applied to the mineral industry. Sources and types of marketrelated 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 Evaluation and Project Assessment

Staff Contact: Mr E.J. Malone

C3

Topics to be covered in the course are: valuation tools and techniques; valuation reports; preliminary investigation; asset determination; impact of financing options; published assessments; feasibility studies; valuation of exploration tenements; residual values of property and plant; variations to value.

KCME4203

Mine Management

Staff Contact: Mr S. Gemmel

C3

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: Centre Office

C3

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: Mr D. O'Neill

C3

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; inhouse environmental training programmes; 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 AsiaPacific 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

C3

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.

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 the behavioural and health sciences 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 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**, and Graduate Diploma in Ergonomics, **5485**. There is also a qualifying course **6347**, which allows nongraduates 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

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 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. 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.

Course requirements. Candidates are required to complete a course totalling 30 credits made up of compulsory

subjects, elective subjects and a project, core subjects (6 credits), elective subjects (12 credits) and a project (12 credits). 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 co-ordinators if they are in doubt as to whether they are qualified to take a subject.

Credit point values are attached to subject descriptions.

There is a wide range of subjects offered by Schools across the entire University which are suitable for inclusion in the MEnvStudies 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. Examples of such tailored programs include:

- land degradation and rehabilitation;
- environmental information systems;
- water resource management;
- urban environment quality;
- waste water treatment;
- environmental safety.

Other tailored programs can be organised, depending on student needs.

The elective subjects 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.

The elective subjects listed below are listed under various themes; other subjects are available within these (and other) themes.

Core Subjects

GEOG9180	Environmental Planning and Evaluation
SAFE9272	Environment and Medicine
SAFE9273	Environment and Law Project
SAFE9612	12 credit Research Project in Environmental Studies

Elective Subjects*

Pollution

CHEM3311	Environmental Chemistry
FUEL5860	Unit Operations in Waste Management
FUEL5910	Atmospheric Pollution Control Theory
FUEL5920	Practical Aspects of Air Pollution Measurement and Control
GEOL9012	Contaminant Hydrogeology

Health

SAFE9263	Chemical Safety and Toxicology
CIVL9851	Unit Operations in Public Health Engineering
CIVL9868	Public Health Science
GEOG9230	Population, Health and Environment
SAFE9260	Introduction to Occupational Health
SAFE9352	Hazard and Risk Analysis
SAFE9531	Community Noise Control
SAFE9553	Radiation Protection

Earth Science

GEOG3011	Pedology
GEOG9320	Soil Degradation and Conservation
GEOL2072	Environmental Geology
GEOL3072	Engineering Geology

Biological Systems

BIOS3061	Plant Ecosystem Processes
BIOS3071	Conservation Biology and Biodiversity
BIOT7081	Environmental Biotechnology
GEOG3021	Biogeography
GEOG9300	Vegetation Management

Water Management

CEIC5630	Industrial Water and Waste Water Engineering
CIVL9847	Water Resources Policy
CIVL9858	Water Quality Management
INDC4110	Water Chemistry
GEOG9310	River Management

Conservation and Land Management

LAND9010	Environmental Heritage Studies
LAND9111	Landscape Planning
LAND9212	Landscape Planning Methods
LAND9213	Land Systems and Management
LAND9214	Visual Landscape Assessment

Safety Science

SAFE9523	Machines and Structures Safety
SAFE9533	Electrical Safety
SAFE9543	Management of Dangerous Materials
SAFE9544	Traffic Safety

Urban and Social Environments

GEOG3192	Urban and Regional Development
GEOG9120	Settlement in Australia
SAFE9242	Effective Behaviour in Organizations

Information Systems

GEOG9150	Remote Sensing Applications
GEOG9160	Directed Problems in Remote Sensing
GEOG9210	Computer Mapping and Data Display
GEOG9240	Principles of Geographic Information Systems

Planning and Assessment

CIVL9888	Environmental Management and Economics
GEOG3042	Environmental Impact Assessment
PLAN0911	The Organisation of Town Planning

Other

GEOG9250	Special Topic
SAFE9503	Special Report in Safety Science

*Other subjects may be added on approval of Course Coordinator

All students must undertake an investigative project of 12 credit points. This project is expected to be completed within one University session (that is, six months). Students will require an academic supervisor for the duration of the project.

Projects normally require original research in the collection and analysis of data, leading to the preparation of a report of about 10,000 words. The project can be based in 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)

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 36 credit points, made up of 15 credits points of compulsory subjects, 12 credits points of elective subjects and a 9 credit point Project. For candidates with previous ergonomics qualifications an 18 credit point Project may be undertaken in place of 9 credit points of subjects.

Candidates with a three year degree are admitted first to the Graduate Diploma in Ergonomics but may upgrade to the Master of Applied Science in Ergonomics on satisfactory completion of 18 credit points, 9 of which are transferred to the Master of Applied Science degree.

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
SAFE9011	Principles of Engineering Mechanic
SAFE9012	Statistics for Health & Safety Scientists

Core Subjects

SAFE9260	Introduction to Occupational Health or
SAFE9211	Introduction to Safety Engineering
PSYC7110	Advanced Ergonomics
SAFE9224	Principles of Ergonomics
SAFE9242	Effective Behaviour in Organisations
SAFE9424	Applied Ergonomics

* Students with an engineering or physics background may take SAFE9213 which covers similar material as SAFE9211.

Electives

BIOM9541	Mechanics of the Human Body
SAFE9211	Introduction to Safety Engineering
SAFE9213	Introduction to Safety Engineering M
SAFE9232	Introduction to Occupational Health & Safety Law
SAFE9260	Introduction to Occupational Health
SAFE9261	Occupational Hygiene
SAFE9262	Occupational Medicine
SAFE9263	Chemical Safety & Toxicology
SAFE9342	Management for Safety
SAFE9343	Innovation, Productivity and Safety
SAFE9352	Hazard & Risk Analysis
SAFE9523	Machines & Structures Safety
SAFE9551	Experimental Biomechanics
SAFE9544	Traffic Safety
SAFE9563	Assessment of the Workplace Environment

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 9 Credit points value (SAFE9609) although in special cases, for example when a student enters the course with substantial background in the core material, a superior Project of 18 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 30 credits points of study, 12 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 credits 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 9 credits points of compulsory subjects, and 9 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 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

(3 credits 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 12 credit points value. Projects may be based on studies carried out at a students 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:

(2 credit points)

MECH9325	Fundamentals of Noise
MECH9326	Advanced Noise
MNGT0373	Organizational Design

(3 credit points)

CIVL9726	Construction Law and Professional Practice
ELEC9410	Robotics Automation and Productive Technique
IROB5701	Industrial Relations
MANF9400	Industrial Management
MANF9410	Inspection and Quality Control
MECH9400	Mechanics of Fracture and Fatigue
MINE1224	Mining Engineering Technology
MINE1534	Environmental Conditions in Mines
MINE9164	Atmospheric Pollution and Control (Theory)

Other Subjects from AGSM by arrangement

8671

Master of Safety Science

MSafetySc

Candidates are required to complete a program totalling 45 credit points made up of 24 credit points of compulsory subjects, 12 credit points of electives and a 9 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 45 credit programme. 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

(3 credit points)

ANAT6151	Introductory Functional Anatomy
SAFE9011	Principles of Engineering Mechanics
SAFE9012	Statistics for Health and Safety Scientists
SAFE9122	Computing for Safety Science

Core Subjects

Core subjects, totalling 24 credits, represent the central theme of Safety Science and are compulsory.

(3 credit points)

SAFE9260	Introduction to Occupational Health
SAFE9211	Introduction to Safety Engineering
SAFE9224	Principles of Ergonomics
SAFE9232	Introduction to Occupational Health and Safety Law
SAFE9242	Effective Behaviour in Organisations
SAFE9342	Management for Safety
SAFE9352	Hazard and Risk Analysis

Electives

Students are required to take at least 12 credit points from the list below.

(2 credit points)

HEAL9411	Epidemiology
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(3 credit points)

BIOM9541	Mechanics of the Human Body
CHEM7325	Toxicology, Occupational & Public Health
SAFE9142	Organisational Communication for Safety
SAFE9424	Applied Ergonomics
SAFE9523	Machines & Structures Safety
SAFE9531	Industrial & Environmental Noise
SAFE9533	Electrical Safety
SAFE9543	Management of Dangerous Materials
SAFE9544	Traffic Safety
SAFE9553	Radiation Protection
SAFE9561	Occupational Health Practice
SAFE9563	Assessment of the Workplace Environment
SAFE9573	Fire and Explosion
SAFE9583	Ventilation

(4 credit points)

LAWS5020	Industrial Safety & Health Law
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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. The following is a selection of approved subjects:

CMED9600	Disability
CMED9604	Alcohol and Drug Related Problems
CMED9609	Health and Illness Behaviour
IROB5701	Industrial Relations A
MANF9400	Industrial Management
MEED9108	Program Evaluation and Planned Change
MEED9125	Planning, Conducting and Evaluating Educational Workshops

Project

Project Students are required to undertake an investigative project and to present a satisfactory report. The project will normally be of 9 credits value (SAFE9609). In special circumstances, for example when a student enters the course with substantial prior knowledge in the coursework, a superior Project Report of 18 credits 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 two such seminars in each Session.

5480

Graduate Diploma in Safety Science

GradDip

The Graduate Diploma in Safety Science Course consists of three major components, totalling 30 credits points. They are preliminary subjects, core subjects and elective subjects. Some subjects must be taken in a prescribed sequence.

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 Principles of Engineering Mechanics. 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.

(3 credit points)

ANAT6151	Introductory Functional Anatomy
SAFE9011	Principles of Engineering Mechanics
SAFE9012	Statistics for Health & Safety Scientists
SAFE9122	Computing for Safety Science

Core Subjects

Core subjects, totalling 18 credits, represent the central theme of safety science and are compulsory.

(3 credit points)

SAFE9211	Introduction to Safety Engineering
SAFE9224	Principles of Ergonomics
SAFE9232	Introduction to Occupational Health & Safety Law
SAFE9242	Effective Behaviour in Organisations
SAFE9260	Introduction to Occupational Health
SAFE9352	Hazard and Risk Analysis

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 programme. In special cases a 3 credit point Report in Safety Science SAFE9603 may be taken.

5485

Graduate Diploma in Ergonomics GradDip

The Graduate Diploma in Ergonomics is a multidisciplinary course and is designed to accept students from a range of backgrounds. The course consists of three major components totalling 30 credit points: Preliminary subjects, Core subjects and Electives. All students must take 15 credit points from the Core subjects, with the remainder being selected from the Preliminary and Elective subjects. Some subjects must be taken in a prescribed sequence. Prerequisite subjects are shown below; equivalent prerequisites may be acceptable.

Preliminary Subjects

Preliminary subjects are chosen according to the student's first degree. Most health professionals would need to study Principles of Engineering Mechanics but not Introductory Functional Anatomy, while engineers and physicists would study Introductory Functional Anatomy but not Principles of Engineering Mechanics. Statistics for Health and Safety Scientists would be taken only by students who have not completed a suitable statistics subject in their first degree.

Selection of these subjects depends on entry qualifications, and is subject to approval by the Ergonomics Course Coordinator.

(3 credit points)

ANAT6151	Introductory Functional Anatomy
SAFE9011	Principles of Engineering Mechanics
SAFE9012	Statistics for Health & Safety Scientists

Core Subjects

Core subjects, totalling 15 Credits, represent the central theme of ergonomics, and are compulsory.

(3 credit points)

SAFE9211	Introduction to Safety Engineering or
SAFE9260	Introduction to Occupational Health
PSYC7110	Advanced Ergonomics
SAFE9224	Principles of Ergonomics
SAFE9242	Human Behaviour & Safety Science
SAFE9242	Effective Behaviour in Safety Science
SAFE9424	Applied Ergonomics

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 MAppSc

(Ergonomics) programme. 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.

Subject Descriptions

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

SAFE9011**Principles of Engineering Mechanics**

Staff Contact: Prof Jean Cross

C3

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

C3

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.

SAFE9122**Computing for Safety Science**

Staff Contact: Head of School

C3

Microcomputer hardware and software; the DOS operating system; creation and storage of data and files; fundamentals of word processing, data bases, and spreadsheets; management and analysis of occupational health and safety related data; the BASIC programming language; flow charts, program structure and errors; writing BASIC programs to analyse health and safety related problems and/or to calculate related parameters.

SAFE9142**Organizational Communication for Safety**

Staff Contact: Dr Ronald Rosen

C3

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 programmes. Organizational communication diagnosis and change.

SAFE9211**Introduction to Safety Engineering**

Staff Contact: Dr Ronald Rosen

C3

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: Basic safety practice; management of dangerous materials; fire and explosion; ventilation; noise control; radiation protection; electrical safety; biosafety, machine dangers and machine guarding; construction safety; transport safety; environmental safety; plant safety assessment.

SAFE9213**Introduction to Safety Engineering M**

Staff Contact: Dr Ronald Rosen

C3

Assumed knowledge: SAFE9011 or PHYS1022

The treatment of the following topics covers similar material as SAFE9211, but assumes a basic knowledge of differential calculus. The following workplace topics are considered; safety management, ergonomics, equipment design and task consideration, machine guarding, electrical safety, fire and explosion, management of dangerous materials, ventilation, radiation protection, noise and vibration control, environmental safety, transport safety, safety issues in different industries.

SAFE9224**Principles of Ergonomics**

Staff Contact: Dr Kamal Kothiyal

C3

Assumed knowledge: SAFE9011 or PHYS1022

Note/s: A project forms a substantial proportion of the assessment for this subject.

Applied anatomy and kinesiology, anthropometry; application to work place arrangement, seating and bench design, tool and equipment design, lifting techniques,

consumer product and architectural design. Physiological and psychological aspects of work and fatigue; measurement of energy consumption, limits to energy expenditure at work, static muscular fatigue, boredom. Environment effects; natural and artificial lighting arrangements, problems of perception, colour; noise and vibration, heat and ventilation, thermal regulation in humans, criteria for comfort. Person-machine interfaces, displays, machine controls, reaction times, vigilance. Applications of ergonomics to occupational safety and health. Ergonomic research methodology.

SAFE9232

Introduction to Occupational Health and Safety Law

Staff Contact: Head of School

C3

The concept of law: the creation and interpretation of statutes: the judicial and court systems: locus standi: common law and equity: basic principles of legal liability (civil and criminal): basic principles of administrative law and the liability of the Crown: the common law of employment: statutory regulation of employment: compulsory arbitration of industrial disputes. Outline of occupational health, safety and compensation legislation of the Australian States. Actions under the common law.

SAFE9242

Effective Behaviour in Organisations

Staff Contact: Ms Dianne Gardner

C3

Human behaviour as a major system factor in occupational safety and health. Learning and safety programs. Attitudes and attitude change. Safety compliance individual and group factors affecting compliance. Work motivation and safety practice. Accident proneness and personnel selection. Individual differences in attitudes to work. Planning and implementing organizational change.

SAFE9260

Introduction to Occupational Health

Staff Contact: Dr Chris Winder

C3

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: Dr Chris Winder

C3

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: Dr Chris Winder

C3

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: Dr Chris Winder

C3

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 Chris Winder

C3

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: Dr Chris Winder

C3

Assumed knowledge: SAFE9262

A workplace assessment based subject, where students will be required to report on occupational health problems in a number of diverse industrial sites.

SAFE9267

Research Methods in Laboratory Science

Staff Contact: Dr Boban Markovic

C3

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: Dr Chris Winder

C2

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: Dr Chris Winder
C2

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
C3

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
C3

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
C3

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
C3

Prerequisite: SAFE9224 at credit level or equivalent

Decision making, vigilance, effects of workload and stress, applications to screenbased 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.

SAFE9523**Machines and Structures Safety**

Staff Contact: Dr Kamal Kothiyal
C3

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, nondestructive testing.

SAFE9531**Industrial & Environmental Noise**

Staff Contact: Head of School
C3

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, phons 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, reverberant, 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
C3

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: Dr Chris Winder
C3

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: Mr Roger Hall
C3

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

C3

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

C3

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.

SAFE9561

Occupational Health Practice

Staff Contact: Head of School

C3

Assumed knowledge: CMED9701 and SAFE9261

This subject provides an opportunity for experiential learning in topics related to Occupational Health Practice. Students will visit six diverse industrial sites and centres for occupational health control. Before each visit the student must be aware of the possible health problems specific to that site or centre. A nominated preceptor will be available at each site or centre. Reports on each of these visits will be required; two reports must be substantial. Students enrolled in the Master of Safety Science or Diploma in Safety Science courses, who have paramedical qualifications will be best suited for this subject.

SAFE9563

Assessment of the Workplace Environment

Staff Contact: Dr Keith Post

C3

University entrance level Maths, Physics, Chemistry. (Some knowledge or experience in Occupational Hygiene) Experimental design and practical measurements of the physical and chemical components of the workplace and general environment with reference to their impact upon health and safety. One quarter of the subject is allocated to formal lectures which outline measurement methods, experimental strategies and reporting procedures which

are useful for constructing successful measurement programs. In the remaining time students design and carry out a number of practical measurement programs to access and report on the environment in terms of parameters such as noise, toxic dusts, flammable gases, floor friction, strength of materials forces associated with manual tasks, temperature, humidity and radiant heat, lighting, radiation, electromagnetic fields, and vibration.

SAFE9573

Fire and Explosion

Staff Contact: Head of School

C3

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.

SAFE9583

Ventilation

Staff Contact: Head of School

C3

Assumed knowledge: Maths Physics & Engineering Mechanics

Nature of airborne contaminants: gases, vapours, dusts, heat and fumes. Assessment criteria. Ventilation systems for contaminant control: booths, enclosures, receiving and capture hoods, general dilution systems and natural ventilation. Design methods based on capture velocity, face velocity, control velocity and flow ratio principles. Properties of fan and duct systems. Alternatives to ventilation. Three laboratory sessions: air flow measurement, fans, capture hoods.

SAFE9601

Report in Safety Science

Staff Contact: Dr Chris Winder

A one credit report on a topic in safety science.

SAFE9602

Report in Safety Science

Staff Contact: Dr Chris Winder

A two credit report on a topic in safety science.

SAFE9603

Special Report in Safety Science

Staff Contact: Dr Ronald Rosen

C3

Only for students enrolled in the Graduate Diploma courses.

SAFE9609

Project

Staff Contact: Dr Ronald Rosen

C9

SAFE9612

12 Credit Project in Safety Science or Environmental Studies

Staff Contact: Dr Ronald Rosen (Safety Science)

Staff Contact: Dr Chris Winder (Environmental Studies)

C12

SAFE9618

Project Report

Staff Contact: Dr Ronald Rosen

C18

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 Membrane and Separation Technology
Centre for Minerals Engineering
Centre for Particle and Catalyst Technologies
Centre for Petroleum Engineering Studies
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. The Centre for Petroleum Engineering Studies has a separate entry in this handbook at the end of this section.

In addition the Faculty of Applied Science is actively involved with seven Co-operative Research Centres (CRCs) established under the Commonwealth Government's program of CRCs announced in 1991. These are:

- Australian Maritime Engineering CRC
- CRC for Aerospace Structures in which the School of Materials Science and Engineering has a strong involvement.
- CRC for Biopharmaceutical Research in which the Department of Biotechnology has a leading role.
- Australian Petroleum CRC in which the Centre for Petroleum Engineering Studies has a leading role.
- CRC for Waste Management and Pollution Control in which the School of Chemical Engineering and Industrial Chemistry has a major supporting role. The Department of Biotechnology is also involved in the Centre's projects.
- CRC for Food Industry Innovation in which the Departments of Biotechnology and Food Science and Technology have leading roles.
- Premium Quality Wool CRC in which the School of Wool and Animal Sciences is one of the core partners. The School's principal involvement is in the education program of the CRC.

Bioengineering Centre

Director:
Professor P. Gray

The Bioengineering Centre is located in the Department of Biotechnology within the School of Applied Bioscience. Its aim is to provide a focus for the application of recombinant DNA and bioengineering techniques to research related to the development of useful products and processes. The Centre brings together expertise in molecular biology, cloning and expression, growth and product recovery from recombinant cells and characterisation and computer modelling of protein structure.

Additional activities of the Centre include continuing education programs and extensive collaborations with local and overseas organisations with similar interests.

Centre for Membrane and Separation Technology

Directors:
Professor H.G.L. Coster (Biophysics Group)
Professor A.G.Fane (Chemical Engineering Group)

The Centre for Membrane and Separation Technology is one of the Australian Government's Commonwealth Special Research Centres established to carry out intensive research into membrane technology. The research programs of the Centre are twofold: to determine the factors underlying the fouling of membranes, particularly ultrafiltration and microfiltration membranes; and to develop biomimetic membranes by implanting biospecies on synthetic membranes.

The Centre is a joint enterprise between the Department of Biophysics in the Faculty of Science and the School of Chemical Engineering and Industrial Chemistry in the Faculty of Applied Science.

Centre for Minerals Engineering

Director:
Dr T. Tran

Jointly run by the School of Chemical Engineering and Industrial Chemistry, the School of Mines and the School of Materials Science and Engineering, the Minerals 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 and was established to encourage and facilitate interdisciplinary research in particulate systems and heterogeneous catalysis undertaken within the University by promoting unique University facilities as services available to industry and government bodies. The Centre now houses over \$2m worth of equipment for characterisation of particulate and catalyst systems which is used to assist industry in trouble-shooting and quality control projects as well as fundamental research. Postgraduate and continuing education courses in Particle Characterisation and Catalyst Technology are offered annually.

Centre for Petroleum Engineering Studies

Director:
Professor W.V. 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. Petroleum engineers apply physical, mathematical and engineering principles to identify and solve problems associated with exploration, exploitation, drilling, production, processing, transportation and all the related economic and management problems associated with recovery of hydrocarbons from deep beneath the earth's surface.

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 identical to the first two years of the Chemical Engineering Course. The only exception is that Petroleum Engineering students take the whole of Category A General Education subjects in the first year and the whole of Category B General Education subjects in the second year. 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.

It is compulsory that, before completion of the course, students in Petroleum Engineering must obtain a minimum of ten weeks' professionally oriented or industrial experience.

Undergraduate Study: Course Outline

3045

Petroleum Engineering - Full-time Course

Bachelor of Engineering BE

		HPW	
		S1	S2
Year 3			
APSE0002	Social Issues in Applied Science*	2	0
CHEN3040	Separation Processes	2	2
CHEN3061	Process Plant Engineering 1	4	3
CIVL0616	Structures	3	0
GEOL5301	Introduction to Petroleum Geology	3	0
GEOL5312	Petroleum Geology & Geophysics	0	3
INDC3070	Instrumentation and Process Control 1	0	3
MATH3021	Mathematics	2	2
PTRL3001	Reservoir Rock Properties and Fluid Flow in Porous Media	2	0
PTRL3002	Rock and Fluid Properties Laboratory	3	0
PTRL3003	Petroleum Thermodynamics	2	0
PTRL3004	Drilling and Production Laboratory	0	3
PTRL3006	Drilling Fluids and Cementing	0	3
PTRL3007	Reservoir Engineering 1	0	2
PTRL3009	Fundamentals of Drilling Engineering	2	0
PTRL3106	Introduction to Formation Evaluation	1	0
PTRL3107	Formation Evaluation I	0	3
Totalling		26	24
Year 4			
CHEN4030	Safety and Environmental*	2	0
CHEN4070	Process Dynamics and Control	3	2
CHEN4080	Design Project	1	4
GEOL5401	Petroleum Production Geology	2	0
PTRL4001	Reservoir Simulation	0	2
PTRL4002	Advanced Recovery Methods	0	2
PTRL4003	Well Pressure Testing	2	0
PTRL4004	Advanced Drilling Engineering	3	0
PTRL4016	Well Completion and Stimulation	0	2
PTRL4026	Petroleum Production Engineering	0	2
PTRL4007	Reservoir Engineering 2	0	2
PTRL4018	Petroleum Economics 1	2	0
PTRL4028	Petroleum Economics 2	0	1
PTRL4105	Formation Evaluation 2	2	2
PTRL4109	Petroleum Engineering Project	4	2
PTRL4010	Communication Skills for Engineers	0	1
Totalling		21	22

*These subjects contribute towards satisfaction of the Category C General Education requirement.

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.

Undergraduate Study : Subject Descriptions

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

APSE0002

Social Issues in Applied Science

Staff Contact: School Office

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: Dr H.A. Salisch

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: Dr H.A. Salisch

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: Dr I.J. Taggart

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: Dr S.S. Rahman

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: Dr S. S. Rahman

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 A.K. Khurana

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: Dr S.S. Rahman

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 H.A. Salisch

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 H.A. Salisch

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 W.V. Pinczewski*

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 I.J. Taggart*

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 I.J. Taggart*

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: Dr S.S. Rahman*

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.

PTRL4016**Well Completions and Stimulation***Staff Contact: Dr S. S. Rahman*

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: Dr S. S. Rahman*

S2 L2

Prerequisites: PTRL3002, PTRL3004, PTRL3006, 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.

PTRL4007**Reservoir Engineering 2***Staff Contact: Prof A.K. Khorana*

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 & line drive). Coning: Chierici solution. Pseudo functions of heterogeneous reservoirs. Hearn/Dykstra-Parsons models. Estimates of reservoir heterogeneity. Dykstra coefficient.

PTRL4018**Petroleum Economics 1***Staff Contact: Mr W.G. Allinson*

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 W.G. Allinson*

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 H.A. Salisch*

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. H.A. Salisch*

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.

PTRL4010**Communication Skills for Engineers***Staff Contact: Dr H.A. Salisch***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.

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	S2
GEOL5301 Introduction to Petroleum Geology	3	0
GEOL5312 Geology of Petroleum Accumulations	0	3
PTRL5001 Reservoir Rock Properties	2	0
PTRL5002 Rock and Fluid Properties	3	0
PTRL5003 Well Pressure Testing	2	0
PTRL5004 Reservoir Simulation Fundamentals	0	2
PTRL5005 Petroleum Thermodynamics	2	0
PTRL5016 Well Completion and Stimulation	0	2
PTRL5026 Petroleum Production Engineering	0	2
PTRL5007 Reservoir Engineering	0	2
PTRL5008 Petroleum Production Economics	2	0
PTRL5009 Fundamentals of Drilling Engineering	2	0
PTRL5012 Drilling Fluids and Cementing	0	3
PTRL5106 Introduction to Formation Evaluation	1	0
PTRL5107 Formation Evaluation	0	3
PTRL5109 Petroleum Engineering Project	2	2
Totalling	19	19

Graduate Study: Subject Descriptions

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

PTRL5001**Reservoir Rock Properties and Fluid Flow in Porous Media***Staff Contact: Dr H.A. Salisch***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: Dr H.A. Salisch***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 I.J. Taggart
S1 L2

Theory of transient well testing. Practical aspects of design and performance of field test instrumentation. Pressure buildup tests. Pressure drawdown tests. Falloff tests. Multirate tests. Gas well testing. Flowafterflow. Isochronal and isochronal modified. Interference testing. Pulse testing. Drill stem tests. Fractured reservoir tests.

PTRL5004**Reservoir Simulation Fundamentals**

Staff Contact: Prof W.V. Pinczewski
S2 L2

Formulation of reservoir simulation equations. Explicit and implicit solution procedures. Cartesian and radial geometry. Single dimensional, twophase 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: Dr I.J. Taggart
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.

PTRL5016**Well Completion and Stimulation**

Staff Contact: Dr S.S. Rahman
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.

PTRL5007**Reservoir Engineering**

Staff Contact: Prof A.K. Khurana
S2 L2

Basics of phase behaviour, equation of state modelling of gasliquid systems, reservoir material balances. Identification of major recovery drive mechanisms. Water influx calculations. Well productivity.

PTRL5008**Petroleum Production Economics**

Staff Contact: Mr W.G. Allinson
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: Dr S.S. Rahman
S1 L2

Rotary drilling rig components. Drilling fluid circulating system. Bottomhole assemblies, well control and blowout prevention equipment and methods. Special marine equipment and drilling cost analysis.

PTRL5012**Drilling Fluids and Cementing**

Staff Contact: Dr S.S. Rahman
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.

PTRL5106**Introduction to Formation Evaluation**

Staff Contact: Dr H.A. Salisch
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 H.A. Salisch
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**

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.

Centre for Remote Sensing and Geographic Information Systems

Director:

Dr A. P. Skidmore

Deputy Director:

Professor J. C. Trinder

The Centre for Remote Sensing and Geographic Information Systems is a joint multidisciplinary enterprise of the Faculty of Applied Science and the Faculty of Engineering.

Graduate Programs in Geographic Information Systems

Master of Applied Science in Geographic Information Systems Course **8024**

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 Surveying Science Course **8651**. 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 **8026**

Graduate Diploma in Remote Sensing Course **5026**

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 G. D. Sergeant

ERDIC provides a contact point for energy researchers at UNSW and acts as a focus for enquiries and consultations on energy technologies. The Centre organises seminars, workshops and meetings and has brought multidisciplinary teams together to work on energy projects. ERDIC has put together a twelve unit subject on Energy Management which is offered as a subject in the Master of Business and Technology.

Food Industry Development Centre

Director:

Dr P. Cranston

This is a Commonwealth Key Centre located in the Department of Food Science and Technology within the School of Applied Bioscience. The Centre focusses on research and training and most importantly liaison with the Australian food industry.

Key Centre for Mines

Director:

Associate Professor G.R.Taylor

The Key Centre is a joint initiative of the Universities of New South Wales and Wollongong. Funded by the Department of Employment, Education and Training. The purpose of the Key Centre for Mines is to provide a full range of educational and research services to the minerals industries.

Particular emphasis is being placed on continuing education, distance learning 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.

Information on the Centre's courses is detailed under the School of Mines section in this handbook.

UNSW Groundwater Centre

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 Department of Applied Geology in the Faculty of Applied Science and the School of Civil Engineering in the Faculty of Engineering 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.

Information on the Centre's courses is detailed under the Department of Applied Geology, School of Mines, section in this handbook.

Servicing Subject Descriptions

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

The following subjects are offered by other Faculties at UNSW, and contribute as either part of courses contained in this handbook, or as electives.

ACCT1501

Accounting and Financial Management 1A

Staff Contact: School Office

S1 or S2 L2 T2

This is the first unit in a sequence of subjects dealing with aspects of the practice of financial reporting. This subject reviews the analytical and investigative tools and processes used within the discipline of accounting, including the basic accounting process, whereby financial data from source documents are recorded, processed, summarised and adjusted (in terms of a given set of accounting concepts) and culminating in the preparation of financial reports. Also the design of accounting systems and incorporation of internal controls; accounting for cash, debtors, inventories and property, plant and equipment; uses and limitations of traditional financial reports.

ACCT1511

Accounting and Financial Management 1B

Staff Contact: School Office

S1 or S2 L2 T2

Prerequisite ACCT1501

The second unit in a sequence of financial accounting subjects. Includes: the definition and recognition of assets, liabilities, revenues and expenses; partnerships; joint ventures and corporations; financing decisions and financial management; financial statement analysis; aspects of the contemporary institutional and regulatory environment of external financial reporting; alternative accounting systems incorporating different measurement unit capital maintenance and valuation concepts; an overview of accounting for investments; preparation of simple funds statements.

ACCT2522

Accounting and Financial Management 2A

Staff Contact: School Office

S1 L2 T2

Prerequisites: ACCT1511

Note/s: Excluded ACCT2532.

This subject looks at the design and operation of management accounting systems, including product costing systems and budgeting, planning and control systems. In particular, attention is focused on the theoretical and practical implications of management accounting system design on organizational functioning, with emphasis on both manufacturing and service organizations. Involves the use of spreadsheet modelling and the use of personal computer.

ACCT2542

Accounting and Financial Management 2B

Staff Contact: School Office

S2 L2 T2

Prerequisite ACCT1511

Note/s: Excluded ACCT2552.

The third financial reporting unit after ACCT1501 and ACCT1511 with a consideration of more complicated transactions and events as well as the accounting problems in certain specific industries. Looks at: the contracting cost and other frameworks for the analysis of financial reporting; more advanced aspects of accounting for shareholders' equity, liabilities and assets including interperiod company tax allocation and lease accounting; accounts of a company; Profit and Loss account, balance sheet, and summary of sources and applications of funds; and the application of computer technology to financial accounting problems.

ACCT5940

Auditing

Staff Contact: School Office

S1 or S2 L3

Prerequisite: ACCT5970 or equivalent

Selected aspects of auditing. Topics include: auditing standards and responsibilities, problems of verification and reporting; organization and application to various forms of accounting systems including computer-based systems; appraisal of methods of internal control; the applicability of particular audit techniques including statistical sampling.

ACCT5956

Management Planning and Control

Staff Contact: School Office

S2 L3

Planning and control processes in organizations, and the involvement of management and management support personnel with them. Topics include: 'formal' and 'organizational' perspectives on management planning and control; planning and decision-making in organizations –

some alternative perspectives and descriptions; planning and budgeting – theoretical perspectives and organizational descriptions; organization structures and structuration; control processes in organizations – some alternative perspectives; participation as a mode of organizational control; accounting control systems – some alternative perspectives; designing management accounting systems - prescription or organizational choice; categorizing and evaluating the literatures on management planning and control.

Anatomy

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.

Australian Graduate School of Management

MNGT0204

Macroeconomics for Managers

Recommended: MNGT0200 or MNGT0206 or consent of instructor

Macroeconomics studies the behaviour of aggregate economic activity relating to output, employment and prices in periods of boom and slump. Special emphasis is placed on the performance of the Australian economy. The course is not designed to make you a professional macro-economist but rather to equip you as a manager with sufficient knowledge to cope with major fluctuations in the economy. Examples drawn from several countries.

MNGT0373

Organizational Design

Prerequisite: MNGT0270 or consent of instructor

Extends the structural analysis of organizations introduced in MNGT0270 or equivalent. Topics include power, informal organization, 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.

MNGT0385

Business-Government Relations

The relationship between business and government in Australia in historic and comparative contexts. Covers the emerging business government issue agenda, developments in the institutions mediating

business-government relations, industry policy and Australian political 'futures'.

Banking and Finance

FINS2613

Business Finance 2A

Staff Contact: School Office

S1 or S2 L2 T1

Prerequisites: ACCT1511, ECON1102 and ECON1203

Looks at the essential aspects of financial decision-making in business including: factors influencing capital expenditure decisions; alternative approaches to valuation; factors affecting the formulation of the capital structure; influence of the capital market environment.

FINS5517

Portfolio Analysis and Management

Staff Contact: School Office

S1 or S2 L3

Prerequisite: FINS5513

Management of equity and fixed interest portfolios using modern market-based methods of risk control. Derivative instruments: forwards; futures; options; swaps; FRA's etc. Equity investments: valuation; diversification; portfolio insurance; program trading; international diversification and hedging; performance measurement. Fixed interest portfolios: term structure; duration; convexity; gap analysis; hedging. Alternative assets.

Biochemistry and Molecular Genetics

BIOC2312

Principles of Biochemistry and Molecular Biology

Staff Contact: Dr K. Moon

U2 F HPW6

Prerequisites: BIOS1011 and BIOS1021, CHEM1101 and CHEM1201 or CHEM1002

Note/s: Excluded BIOC2101, BIOC2372, CHEM2929. 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.

The chemical properties of amino acids, peptides and proteins, carbohydrates, nucleic acids and lipids and the biological roles of these compounds. The nature and function of enzymes. The intermediary metabolism of carbohydrates, lipids and nitrogenous compounds. The relationship between structure and function of enzymes, other proteins, hormones and biological membranes. Metabolic networks and control mechanisms. The molecular mechanism of gene expression and protein synthesis. Regulation of gene expression. Recombinant DNA technology and protein engineering. Introduction to biotechnology. Photosynthesis. Practical work to complement the lectures.

BIOC3121**Molecular Biology of Nucleic Acids***Staff Contact: A/Prof A. Mackinlay*

U1 S1 HPW6

Prerequisites: BIOC2312, 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, DNADNA and DNARNA 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*

U1 S2 HPW6

Prerequisite: BIOC3121*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 noncoding 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.

BIOC3111**Molecular Biology of Proteins***Staff Contact: Dr G. King*

U1 S1 HPW6

Prerequisites: BIOC2312, 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-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.

BIOC3271**Cellular Biochemistry and Control***Staff Contact: Dr M. Edwards*

U1 S2 HPW6

Prerequisite: BIOC2312

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 biology are encouraged to take both subjects. Practical work amplifies the lectures.

Biomedical Engineering

BIOM9541**Mechanics of the Human Body***Staff Contact: Prof N.L. Svensson*

C3 SS L2 T1

Prerequisites: BIOM9510 and ANAT2111

Statics and dynamics of the musculoskeletal system: mathematical modelling and computer simulation, analysis of pathological situations.

Biological Science

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:

8-11 Feb 1000-1700

14-18 Feb 1000-1700

21-25 Feb 1000-1700

(late closing 9 and 16 Feb - 2100)

Students must obtain practical slots at that time for:

BIOS2011 Evolutionary and Physiological Ecology

BIOS2021 Introductory Genetics

BIOS2051 Flowering Plants

BIOS2061 Vertebrate Zoology

BIOS3071 Conservation Biology and Biodiversity

Pre-enrolment or 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.

BIOS1011**Biology A***Staff Contact: Dr M.L. Augee*

U1 S1 HPW6

Prerequisites: HSC Exam Score Required: 2 unit Science (Physics) 53100, or 2 unit Science (Chemistry) 53100, or 2 unit Science (Geology) 53100, or 2 unit Science (Biology) 53100, or 3 unit Science 90150, or 4 unit Science 150

Notes: 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 it for details of the course and assessments.

The biology of cells; their structure as seen with light and electron microscopes; how they move, take in and excrete substances; their chemistry and use of energy. Inheritance and mutations; genes and how they work. The theory covered in the lectures and tutorials is illustrated by observation and experiment in laboratory classes.

BIOS1021**Biology B***Staff Contact: Dr M.L. Augee*

U1 S2 HPW6

Prerequisites: BIOS1011

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

BIOS2011**Evolutionary and Physiological Ecology***Staff Contact: Dr P Steinberg*

U1 S1 HPW6

Prerequisites: BIOS1011 and BIOS1021

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*

U1 S2 HPW6

Prerequisites: BIOS1011 and BIOS1021*Corequisite:* BIOC2312

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.

Genome structure and life cycles in prokaryotes and eukaryotes: DNA, gene mapping, cytogenetics. 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*

U1 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*

U1 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.

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, microorganisms 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*

U1 S1 HPW6

Prerequisites: BIOS1011 and BIOS1021

Note/s: Excluded 45.301, 17.732. Practical class allocations must be obtained during reenrolment 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. Participations in field excursions is compulsory. Personal expenses will be incurred.

BIOS3014**Ecological Studies in Arid Lands Management***Staff Contact: Dr D Croft*

S2 L2 T4

Techniques in ecological studies of animal communities. Adaptations to an arid environment, environmental and social determinants. Behaviour, diet and condition of native and feral animals. Competition between native and introduced herbivores. Strategies in the management of arid zone wildlife. Concurrent studies in relevant units in the School of Biological Science are prescribed to cover aspects of vegetation description and plant environment interactions.

BIOS3061**Plant Ecosystem Processes***Staff Contact: Dr R. McMurtrie*

U1 S1 HPW6

Prerequisites: BIOS1011 and BIOS102 and any 2 Level II Science subjects

Soil and atmospheric environments in which plants live and their interaction with the environment. Interactions at scales ranging from the microenvironment to the ecosystem; energy and mass transfer over these scales is investigated and modelled. Impacts of global change on vegetation. Exchange of greenhouse gases between atmosphere and biosphere.

BIOS3071**Conservation Biology and Biodiversity***Staff Contact: Dr W. Sherwin*

U1 S1 HPW6

Prerequisites: BIOS1011 and BIOS1021, plus any 2 Level II Biological Science subjects

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.

Chemistry

CHEM1002**Chemistry 1***Staff Contact: Dr P. Chia*

U2 F HPW6

Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 55100, or 3 unit Mathematics 150, or 4 unit Mathematics 1100 and 2 unit Chemistry 53100, or 3 unit Science 90150, or 4 unit Science 150, or 2 unit Physics 53100*Note/s:* CHEM1002 is the normal prerequisite for Level II Chemistry.

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

CHEM1101**Chemistry 1A***Staff Contact: Dr P. Chia*

U1 S1 HPW6

Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 55100, or 3 unit Mathematics 150, or 4 unit Mathematics 1100 and 2 unit Chemistry 53100, or 3 unit Science 90150, or 4 unit Science 150, or 2 unit Physics 53100

Stoichiometry and solution stoichiometry. Atomic and molecular structure. Changes of state, phase diagrams,

gases, liquids, solids, solutions. Thermodynamics. Equilibrium constants, acidbase and solubility. Oxidation and reduction. Kinetics.

CHEM1201**Chemistry 1B***Staff Contact: Dr P. Chia*

U1 S2 HPW6

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

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

CHEM1302**Introductory Chemistry***Staff Contact: Dr P. Chia*

U2 F HPW6

Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 55100, or 3 unit Mathematics 150, or 4 unit Mathematics 1100*Note/s:* Students who perform very well in CHEM1302 are permitted to continue on to Level II chemistry with the permission of the Head of School of Chemistry.

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. Atomic and Molecular structure, equilibrium constants, acidbase and solubility. Periodicity of physical and chemical properties of elements and compounds. Organic chemistry, including stereoisomerism.

CHEM1401**Introductory Chemistry A***Staff Contact: Dr P. Chia*

U1 S1 HPW6

Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 55100, or 3 unit Mathematics 150, or 4 unit Mathematics 1100

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.

CHEM1807**Chemistry 1ME***Staff Contact: Dr P. Chia*

U1 S1 HPW6

Note/s: excluded CHEM1101, CHEM1201, CHEM1002 Restricted to Course 3681

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

CHEM2011**Physical Chemistry***Staff Contact: Prof R. F. Howe*

U1 S1 or S2 HPW6

Prerequisites: CHEM1002, MATH1032 or MATH1042 or MATH1011 and MATH1021

First, second and third laws of thermodynamics. Applications of thermodynamics. Chemical and phase equilibria. Solutions of electrolytes and nonelectrolytes. Principles and applications of electrochemistry. Reaction kinetics, order and molecularity; effect of temperature on reaction rate. Molecular energy levels. Structure of solids and solid surfaces.

CHEM2021**Organic Chemistry***Staff Contact: Dr R. Read*

U1 F or S2 HPW6

Prerequisite: CHEM1002

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. Roberts*

U1 S1 or S2 HPW6

Prerequisite: CHEM1002

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

CHEM2041**Chemical and Spectroscopic Analysis***Staff Contact: Dr G. Moran*

U1 S1 or S2 HPW6

Prerequisites: CHEM1002, MATH1032 or MATH1042 or MATH1011 and MATH1021

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

CHEM2818**Physical Chemistry for Materials Science and Engineering***Staff Contact: Prof R. F. Howe*

S1 or S2 HPW5

Prerequisites: CHEM1002 or CHEM1101 and CHEM1201 and MATH1042 or MATH1032 or MATH1011 and MATH1021*Note/s:* Excluded 02.022A

First, second and third laws of thermodynamics. Applications of thermodynamics. Chemical and phase equilibria. Solutions of electrolytes and nonelectrolytes. Principles and applications of electrochemistry. Reaction kinetics order and molecularity; effect of temperature on reaction rate.

CHEM2819**Physical Chemistry for Food and Fibre Science and Technology***Staff Contact: Prof R. F. Rowe*

S1 or S2 HPW6

Prerequisites: CHEM1002 or CHEM1101 and CHEM1201 and MATH1042 or MATH1032 or MATH1011 and MATH1021*Note/s:* Excluded 02.002A

First, second and third laws of thermodynamics. Applications of thermodynamics. Chemical and phase equilibria. Solutions of electrolytes and nonelectrolytes. Principles and applications of electrochemistry. Reaction kinetics order and molecularity; effect of temperature on reaction rate. Colloid and surface chemistry; liquid surfaces, surface tension, adsorption, surfactants and detergency, colloidal dispersions and micelles, solid surfaces and adsorption on solids.

CHEM2828**Organic and Inorganic Chemistry for Chemical Engineers***Staff Contact: Prof P. Clezy*

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 d-block transition elements.

CHEM2929**Fundamentals of Biological and Agricultural Chemistry***Staff Contact: Dr P. Southwell-Keely*

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.

CHEM2838**Inorganic Chemistry and Structure for Materials Science***Staff Contact: Dr N. Roberts*

U1 S1 or S2 HPW5

Prerequisite: CHEM1002

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

CHEM3021**Organic Chemistry***Staff Contact: A/Prof M. Gallagher*

U1 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 PaddonRow*

U1 S2 HPW6

Prerequisite: CHEM3021

Modern functional group transformations with particular reference to positional and stereochemical control. Pericyclic reactions and photochemistry; WoodwardHoffman rules. Principles of planning organic synthesis; disconnection approach.

CHEM3311**Environmental Chemistry***Staff Contact: Dr W. Johnson*

U1 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*

U1 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*

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*

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*

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*

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.

Civil Engineering

CIVL0616**Structures***Staff Contact: A/Prof V. A. Pulmano*

S1 L1 T2

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

2Theory 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.

CIVL9726**Legal Studies and Professional Practice***Staff Contact: Prof D.G. Carmichael*

C3 SS

Note/s: Not offered in 1994

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

CIVL9788**Site Investigations***Staff Contact: Prof R. Fell*

C3 S1

Engineering geology mapping and terrain classification. Drilling, trenching and sampling of rock and soil. Insitu testing of soil and rock. Laboratory testing of soil and rock. Assessment of design parameters. Instrumentation to measure pore pressure, stress, displacement.

CIVL9790**Stability of Slopes***Staff Contact: Prof R. Fell*

C3 S2

Stability of natural and constructed slopes in civil and mining engineering. Stability analysis; stabilization methods and design; monitoring. Design of slopes in soft ground, soil and rock, and in partially saturated slopes; design of open cut mines. Probabilistic methods.

CIVL9799**Environmental Geomechanics**

Staff Contact: Mr G.E. Swarbrick
C3 S2

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

CIVL9847**Water Resources Policy**

Staff Contact: Dr J.E. Ball
C3 SS

Note/s: Not offered in 1994

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

CIVL9849**Environmental Hydrology**

Staff Contact: A/Prof I. Cordery
C3 S1

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

CIVL9851**Unit Operations in Public Health Engineering**

Staff Contact: Mr P.J. Bliss
C3 S1

Theory of physical, chemical, biological, and hydraulic processes used in both water and wastewater treatment. Applications where these are common to both water and wastewater treatment.

CIVL9858**Water Quality Management**

Staff Contact: Ms P.A. FitzGerald
C3 SS

Note/s: Not offered in 1994

Fundamental concepts; systems approach to quality aspects of water resource systems; quality interchange systems; quality changes in estuarine, surface, and ground water. Quality management by engineered systems. Economic criteria relating to water use and reuse systems.

CIVL9861**Environmental and Engineering Geophysics**

Staff Contact: Dr R.I. Acworth
C3 S1

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

from groundwater resource, salinity, engineering and contamination fields.

CIVL9868**Public Health Science**

Staff Contact: Ms P.A. FitzGerald
C3 SS

Note/s: Not offered in 1994

Impact of water and wastewater treatment on disease transmission. Monitoring methods used for pathogens and indicator organisms, structure and degradation of large molecules, biochemical pathways of anabolism and catabolism and the characterization of microorganisms.

CIVL9875**Hydrological Processes**

Staff Contact: A/Prof I. Cordery
C3 S1

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

CIVL9880**Groundwater Modelling**

Staff Contact: Dr R.I. Acworth
C3 S1

Groundwater modelling of porous media, fractured rock and low permeability materials. Analogue, numerical analytical models. Matrix structure and inverse methods, stochastic modelling and characterization of variability, modelling multiphase fluids and regional groundwater flow. Applications to borefield management, salt water intrusion, mine dewatering, geotechnical problems.

CIVL9888**Environmental Management and Economics**

Staff Contact: Prof D.L. Wilkinson
C3 S2

Spectrum of modern environmentalism, sustainable development and urban growth. The structure of the environmental regulatory process. Decision making and management systems; case studies; introduction to microeconomics with reference to environmental issues, sustainable economic growth and zero growth. Environmental costing.

Community Medicine

CMED9600**Disability**

Staff Contact: Dr L. Lai
C2

Epidemiology of disabling physical and mental conditions; the nature of disability and handicap (including developmental disability); perceptions of handicap; disabled persons' consumer movement and organization; 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**Alcohol and Drug Related Problems**

Staff Contact: Dr L. Lai
C2

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
C2

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.

Computer Science and Engineering

COMP9311**Data Base Systems**

Staff Contact: Prof J. Hiller
C3 S1 or S2 HPW3

Prerequisites: Assumed knowledge, familiarity with storage structures

Note/s: Excluded 6.659G, 55.823G

A first subject on data base management systems to be presented at a level appropriate for a graduate subject.

The material to be covered will include a selection from: the relational, hierarchic/network, and inverted file data models; normalisation and the problems of redundancies; views and their updates; high level query languages; distributed systems; deductive data bases; data definitions; application generators.

Economics

Department of Economic History

ECOH2301**Management and Business Development**

Staff Contact: Dr J. Perkins

S1 L2 T1

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 organization and the organization 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.

Department of Economics

ECON1101**Microeconomics 1**

Staff Contact: Dr N. Warren

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 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 P. Kriesler

S1 or S2 L2 T1.5

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: A/Prof T. Parry*

S1 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)

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: Ms D. Enahoro*

S2 L2 T1.5

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**Applied Microeconomics***Staff Contact: Dr G. Fishburn*

S2 L2 T1.5

Prerequisite: ECON1102

Note/s: Excluded ECON2101, ECON2121

This subject covers: structural change in the Australian economy; the effect of different market structures on firms and consumer welfare; the consequences of market failure and the effects of government regulation; investment decisions in the public and private sectors, including the estimation of future benefits, revenues and costs; the measurement of consumer and producer surplus; the economics of non-renewable and other resources; and Australia's international trade and investment and the effects of restrictions on international trade and investment.

ECON2104**Applied Macroeconomics***Staff Contact: Dr P. Kriesler*

S1 L2 T1.5

Prerequisite: ECON1102

Note/s: Excluded ECON2102, ECON2122

This subject looks at: economic growth and fluctuations in Australia. Inflation, unemployment and balance of payments issues; fiscal, monetary, exchange rate and income policies; changes in the structure of the Australian financial system and its links with the international monetary system; and effects of restrictions on capital markets.

ECON2108**Industry Economics and Australian Industrial Policy***Staff Contact: Dr R. Stonecash*

S2 L2 T1

Prerequisite: ECON2101 or ECON2103 or ECON2121

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*

S1 L2 T1

Prerequisite: ECON2101 or ECON2121 or ECON2103

Note/s: Excluded ECON2107.

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.

ECON2117**Economics of Tourism***Staff Contact: Dr B. Rao*

S1 L2 T1

Prerequisites: ECON1102

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*

S2 L2 T1

Prerequisite: ECON1101

Note/s: Excluded ECON2107

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 L2 T1

Prerequisite: ECON1102

Note/s: Not offered in 1994.

Electrical Engineering

ELEC0802

Electrical Power Engineering

Staff Contact: Dr B. Farah

S2 HPW3

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

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

ELEC0805

Electronics for Measurement and Control

Staff Contact: Dr B. Farah

S2 L2 T1

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

ELEC9410

Robotics, Automation and Productivity Technology

Staff Contact: A/Prof K.E. Tait

C3

Principles of Robotics relevant to trends in automating the manufacturing process. Such aspects as arm configurations, dynamics and control with relevant sensing methods; assembly and control together with trends in artificial intelligence for Robotics are discussed.

Health Services Management

HEAL9411

Epidemiology

Staff Contact: Dr Mary-Lou McLaws

S1 L2

Principles and methods of epidemiologic investigation of both communicable and noncommunicable diseases including descriptive, analytic and experimental epidemiology. The distribution and dynamic behaviour of disease in the population; data collection, collation and analysis; consideration of screening surveys; longitudinal and casecontrol studies, etc. The uses of epidemiology in planning, operation and evaluation of health services.

Industrial Relations and Organizational Behaviour

IROB1701

Industrial Relations 1A

Staff Contact: Dr B. Ellem

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 organizations 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.

IROB5701

Industrial Relations A

Staff Contact: A/Prof B. Dabscheck

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 industrialization and change; origins and operations of industrial tribunals at the national and state levels; their instrumentalities; nature of industrial conflict and procedures for conflict resolution such as arbitration and bargaining; national wage policy.

IROB5901

Organizational Behaviour A

Staff Contact: Mr J. Holt

SS L3

Note/s: Excluded IROB5906, PSYC7100.

This subject seeks to explain human behaviour within organizations. It draws upon a range of disciplines, but with particular reliance on behavioural sciences of psychology and social psychology and their derived disciplines. Its foci are the individual, the group, and the behavioural processes of organization integration, change and development. Topics covered include personality, perception, attitudes and values, motivation, learning, interpersonal behaviour (and skills), group dynamics, leadership and teamwork, decision - making, power and control, and the behavioural implications of change and development. Wherever appropriate, case examples from Australia will be used. Organization, administrative and management theories and constructs serve as integrating and explanatory frameworks for the subject.

Information, Library and Archive Studies

LIBS0815**Economics of Information Systems***Staff Contact: A/Prof C.J. Maguire*

S1 HPW2

Information as a resource. Effects of information technology on work and the distribution of wealth. Copyright, patents, licences and other systems aimed at ensuring appropriability of economic benefits from information. Market research and the pricing and distribution of information products and services.

LIBS0817**Information Storage and Retrieval Systems***Staff Contact: Mrs C.S. Wilson*

S2 HPW3

Automatic indexing; Automatic thesaurus construction and maintenance; Online searching and information retrieval; Database construction and database software evaluation; Advanced information retrieval techniques; systems analysis, design and costing; advanced technologies for information storage and retrieval.

Information Systems

INFS1602**Computer Information Systems 1***Staff Contact: School Office*

S1 or S2 HPW 4

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 organizational level, typical commercial applications, the systems lifecycle, design concepts, data analysis and models and an introduction to data communications

INFS2603**Computer Information Systems 2***Staff Contact: School Office*

S2 HPW 4

Prerequisite: INFS1602

This subject focuses on system analysis and design: requirements analysis and specification; logical and physical design of business systems; specification and updating of files; man-machine dialogue procedures; and comparison of design methodologies, set within the framework of an actual case study.

INFS5957**Information and Decision Technology***Staff Contact: School Office*

S1 HPW4

The role of information and models in managerial decision making and prediction. The role of information systems in decision making. Assessing the value of information systems and the contribution of information in decision making under uncertainty. The role of information in

managerial prediction and forecasting. The development of computer based models to support tactical management.

Landscape Architecture

LAND9010**Environmental Heritage Studies***Staff Contact: Ms H. Armstrong*

C3

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*

C3 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.

LAND9213**Land Systems and Management***Staff Contact: Ms A. Todd*

C3 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.

Law

LAWS5020

Legal Studies and Taxation

LEGT7711**Legal Environment of Commerce***Staff Contact: School Office*

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 looks at the Australian legal system and areas of substantive law relevant to commerce including contract, business organization, employment, commercial arbitration, advertising, trade regulation, civil compensation, discrimination.

LEGT7731

Legal Regulation of Marketing and Distribution

Staff Contact: School Office

S1 or S2 L2 T1

This subject examines the regulation of restrictive trade practices and sales promotion; the legal framework of marketing strategy with special reference to anti-competitive practices including collusive activity, exclusive dealing, price discrimination, resale price maintenance, mergers and monopolization and consumer protection law including misleading and deceptive advertising and other unfair practices; consumer credit; product liability; protection of intellectual property.

Manufacturing Management

MANF0420

Production Management

Staff Contact: Dr K. Hoang

S1 HPW6

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.

MANF4420

Management of Manufacturing Systems

Staff Contact: Dr K. Hoang

S1 HPW6 S2 HPW2

Prerequisites: MANF3400, MANF3410, MANF3600

Note/s: Excluded MANF0400, MANF4429, MANF9020.

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

MANF9400

Industrial Management

Staff Contact: Dr B. Kayis

C3 SS HPW3

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

MANF9410

Total Quality Management

Staff Contact: Dr B. Kayis

C3 SS HPW3

Note/s: Excluded MANF4429

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

Marketing

MARK2012

Marketing Fundamentals

Staff Contact: School Office

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 Office

S2 L2 T2

Prerequisite: ECON1203 or approved substitute, MARK2012

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.

MARK3073

Brand Management

Staff Contact: School Office

S1 L2 T2

Prerequisite: MARK2012, MARK2042

Note/s: Excluded MARK7073.

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 Office*

S2 L2 T2

Prerequisite: MARK3073**Note/s:** Excluded MARK7083.

Concepts introduced in previous subjects will be broadened to address issues at the business unit level. Corporate mission, competitive stance of the organization, pricing policies, trade relations, internal marketing and logistics will be addressed. The management of organizational resources such as financial and human resources are considered using, for example, portfolio analysis. Decision support systems are also examined.

Mathematics

MATH1011**General Mathematics 1B***Staff Contact: School of Mathematics First Year Office*

U1 S1 HPW6

Prerequisites: HSC exam score range required: 2 unit Mathematics (60100) or 2 and 3 unit Mathematics (1150) or 3 and 4 unit Mathematics (1200). (2 unit Mathematics in this instance refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics subject. It does not refer to the subjects Mathematics in Society or Mathematics in Practice. These numbers may vary from year to year.)

Note/s: Excluded MATH1032, MATH1042, ECON2200, ECON2201, ECON2202.

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 3dimensional geometry; introduction to linear algebra.

MATH1021**General Mathematics 1C***Staff Contact: School of Mathematics First Year Office*

U1 S2 HPW6

Prerequisite: MATH1011**Note/s:** Excluded MATH1032, MATH1042, ECON2200, ECON2201, ECON2202.

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***Staff Contact: School of Mathematics First Year Office*

U2 F HPW6

Prerequisites: HSC exam score range required: 2 unit Mathematics (67100) (from 1995 this will be 90100) or 2 and 3 unit Mathematics (100150) or 3 and 4 unit Mathematics (100200) or MATH1011 (2 unit Mathematics in this instance refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics subject. It does not refer to the subjects Mathematics in Society or Mathematics in

Practice. These numbers may vary from year to year.)

Note/s: Excluded MATH1011, MATH1021, MATH1042, ECON2200, ECON2201, ECON2202.

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

MATH1042**Higher Mathematics 1***Staff Contact: School of Mathematics First Year Office*

U2 F HPW6

Prerequisites: HSC exam score range required: 3 unit Mathematics (145150) or 4 unit Mathematics (186200) (these numbers may vary from year to year.)

Note/s: Excluded MATH1011, MATH1021, MATH1032, ECON2200, ECON2201, ECON2202.

As for MATH1032 but in greater depth.

MATH2009**Engineering Mathematics 2***Staff Contact: School Office*

F HPW4

Prerequisite: MATH1032**Note/s:** Restricted to Combined degree courses **3681, 3730**.

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; introduction to numerical methods; matrices and their application to theory of linear equations, eigenvalues and their numerical evaluation; vector algebra and solid geometry; multiple integrals; introduction to vector field theory.

MATH2021**Mathematics 2***Staff Contact: School Office*

U1 F HPW2

Prerequisite: MATH1021(CR) or MATH1032

Note/s: Mathematics MATH2021 is included for students desiring to attempt only one Level II Mathematics unit. If other Level II units in Pure Mathematics or Applied Mathematics are taken, MATH2021 Mathematics is not counted.

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 Office*

U.5 S1 or S2 HPW2.5

Prerequisite: MATH1032 or MATH1042**Note/s:** Excluded MATH2110.

Properties of vectors and vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss and Stokes' theorems. Curvilinear coordinates.

MATH2120**Mathematical Methods for Differential Equations***Staff Contact: School Office*

U.5 S1 or S2 HPW2.5

Prerequisite: MATH1032 or MATH1042**Note/s:** Excluded MATH2130.

Introduction to qualitative and quantitative methods for ordinary and partial differential equations. The following topics are treated by example. Ordinary differential equations: linear with constant 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 equations, separation of variables methods, applications of Bessel functions and Legendre polynomials.

MATH2819

Statistics SA

Staff Contact: School Office

U1 F HPW2

Prerequisite: MATH1021 or MATH1032

Note/s: Restricted to Science students in programs 6832, 6833 and course 3950.

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.

MATH3021

Mathematics 3

Staff Contact: School Office

U1 F HPW2

Prerequisite: MATH2021

Note/s: Excluded any other Level III in Pure Mathematics or Applied Mathematics except for MATH3261.

Vector calculus; special functions; convolution theorem and applications; complex variable theory; Fourier integrals; Laplace transforms with application to ordinary and partial differential equations.

Mechanical Engineering

MECH0130

Engineering Drawing and Descriptive Geometry

Staff Contact: Dr R.A. Plattfoot

SS L1 T3

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

Graphic communication. First and third angle orthographic projection and isometric projection. Descriptive geometry fundamentals and their application to engineering problems with special emphasis on visualisation of problems and development of methods for their solution. Australian standard engineering drawing practice. Applications involving detail and assembly drawings, functional dimensioning and tolerancing.

MECH0330

Engineering Mechanics

Staff Contact: Dr R.A.J. Ford

SS L2 T2

Prerequisites: As for MECH1300 Engineering Mechanics 1
Note/s: Excluded MECH0360, MECH1300. This is a

servicing subject taught within courses offered by other schools and faculties.

Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pinjointed frames and beams. Simple states of stress. Statics of fluids. Rectilinear motion, curvilinear motion using rectangular and natural coordinates. Simple rotation. Equations of motion. Work, energy and power. Impulse and momentum.

MECH0440

Engineering Statics

Staff Contact: Dr R.A.J. Ford

SS L2 T1

2Prerequisites: 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, pinjointed frames and beams. Simple states of stress. Statics of fluids.

MECH1110

Graphical Analysis and Communication

Staff Contact: Mr A.J. Barratt

S2 L1 T2

Note/s: Excluded MECH0130, MECH0160.

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

MECH1300

Engineering Mechanics 1

Staff Contact: Dr K. Zarrabi

S1 or S2 L2 T2

Prerequisite: HSC Exam Score Range Required Either 2 unit Science (Physics) 53100, or 3 unit Science 90150, or 4 unit Science multistrand 150 or 2 unit Industrial Arts (Engineering Science) 53100, or 3 unit Industrial Arts (Engineering Science) 150

Note/s: Excluded MECH0330, MECH0360. Students who wish to enrol in this subject in courses other than the fulltime courses in Aerospace Engineering, Electrical Engineering, Manufacturing Management, Mechanical Engineering and Naval Architecture can make up for the lack of the prerequisite by work taken in Physics in the first half of the first year.

Equilibrium. Friction. Systems of multiforce members, coplanar and three dimensional. Mass centre; centroid. Fluid statics. Plane particle kinematics: rectilinear, curvilinear and relative motion. Plane particle kinetics: equations of motion; work, power, energy; impulse, momentum, impact.

MECH2300

Engineering Mechanics 2A

Staff Contact: Dr S.S. Leong

S1 or S2 L2 T1

Prerequisites: MATH1032 or MATH1042, MECH1300 or MECH0360

Kinetics of systems of particles; plane steady mass flow. Plane kinematics and kinetics of rigid bodies: moment of inertia; motion relative to translating and rotating frames of reference; equations of motion; work and energy, impulse

and momentum. Virtual work for static and dynamic systems. Kinematics and kinetics of simple mechanisms.

MECH2310

Engineering Mechanics 2B

Staff Contact: J.M. Challen

S1 or S2 HPW2

Corequisite: MECH2300

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

MECH2600

Fluid Mechanics 1

Staff Contact: Prof G.L. Morrison

F L1 T1

Prerequisites: MATH1032 or MATH1042, PHYS1919

Fluid properties. Fluids in static equilibrium. Buoyancy. 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 pipeline system characteristic.

MECH2700

Thermodynamics 1

Staff Contact: A/Prof E. Leonardi

F L1 T1

Prerequisites: MATH1032 or MATH1042, PHYS1919

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

MECH9323

Environmental Noise

Staff Contact: A/Prof K.P. Byrne

C3 SS HPW3

Prerequisite: MECH4321 or equivalent

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

MECH9325

Fundamentals of Noise

Staff Contact: A/Prof K.P. Byrne

C3 SS HPW3

Note/s: Excluded MECH4321, MECH9321

Development of the acoustic plane wave equation. Introduction of the concepts of acoustic impedance, characteristic impedance, acoustic energy density, acoustic intensity and acoustic power. Measurement of sound pressure. Decibel scales. Standing waves. The effect of noise on people. Wave propagation in porous media. Transmission phenomena including transmission of plane waves between different media, through walls and along pipes. The analysis

of expansion chamber mufflers and pipe side-branches. Basic energy approach to room acoustics.

MECH9326

Advanced Noise

Staff Contact: A/Prof K.P. Byrne

C3 SS HPW3

Prerequisite: MECH4321 or MECH9321 or MECH9325

Note/s: Excluded MECH4322, MECH9322

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

MECH9400

Mechanics of Fracture and Fatigue

Staff Contact: Dr K. Zarabi

C3 SS HPW3

Note/s: Excluded MECH4400.

Theories of fracture; failure modes. Ductile, brittle fracture. Mechanics of crack propagation, arrest. Measurement of static fracture properties. Fatigue crack initiation, propagation. Engineering aspects of fatigue.

Medical Education

MEED9102

Educational Process in Small Groups

Staff Contact: Mr G. Roberts

C2 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: A/Prof A. Rotem

C2 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

C1 S1 HPW1

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.

Microbiology and Immunology

MICR2201

Introductory Microbiology

Staff Contact: Dr I. Couperwhite

U1 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

U1 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

U1 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: Dr Y. Barnett

U1 S2 HPW6

Prerequisite: MICR2201

Major topics include the complexity of natural habitats, interaction of microorganisms with their environment with an emphasis on evolution and adaptation, environmental monitoring in aquatic and soil habitats, manipulation of microbial populations in natural habitats including problems with the release of genetically engineered microorganisms. Field work is an integral part of this course and students may be required to bear some personal costs.

Physics

PHYS1002

Physics 1

Staff Contact: First Year Director

U2 F HPW6

Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 67100, or 2 and 3 unit Mathematics (100150), or 3 and 4 unit Mathematics (100200) or (for PHYS1002 only) MATH1011, and 2 unit Science (Physics) 57100, or 2 unit Science (Chemistry) 60100, or 3 unit Science 90150, or 4 unit Science 150 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.

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 Kirchhoff'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.

PHYS1022

Physics 1 For Health and Life Scientists

Staff Contact: First Year Director

U2 F HPW6

Corequisites: MATH1011 and MATH1021 or MATH1032.

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 radioactivity, geometrical optics, optical instruments, wave optics, microscopes and their uses.

PHYS1939

Physics 1 (Building and Industrial Design)

Staff Contact: First Year Director

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.

PHYS2001**Mechanics, and Computational Physics***Staff Contact: Executive Assistant*

U1 S1 HPW4

Prerequisites: PHYS1002, MATH1032.*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*

U1 S2 HPW4

Prerequisites: PHYS1002, MATH1032*Corequisites:* MATH2100*Note/s:* Excluded PHYS2999.

Electric field strength and potential, Gauss' law, Poisson's and Laplace's equations, capacitance, dielectrics and polarisation, magnetism, electromagnetic 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*

U1 F HPW2

Prerequisites: PHYS1002, MATH1032*Note/s:* Excluded PHYS2989.

Waveparticle duality. Operators, postulates of quantum mechanics. Applications: steps, barriers and tunnelling. H atom. Orbital, spin angular momentum, magnetic moment. Spin orbit interaction. Molecules, LCAO, rotation and vibration. Introduction to statistical mechanics. The nucleus: properties, forces, models, fission and fusion. Special theory of relativity, simultaneity, time dilation, length contraction, momentum and energy.

PHYS2031**Laboratory***Staff Contact: Executive Assistant*

U1 F HPW3

Prerequisites: PHYS1002, MATH1032*Note/s:* Excluded PHYS2920.

Experimental investigations in a range of areas: xray 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*

U.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*

U1 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, freeelectron models of metals, band theory, point defects, dislocations.

PHYS3060**Advanced Optics***Staff Contact: Executive Assistant*

U.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*

U.5 S1 HPW4

Prerequisite: PHYS2031

Selected experiments and projects. Advanced experimental techniques and open ended projects in the areas covered in PHYS3041 Experimental Physics A together with projects involving electron and nuclear magnetic resonances, low temperature physics and superconductivity. Fourier optics, holography.

PHYS3120**Experimental Physics B2***Staff Contact: Executive Assistant*

U.5 S2 HPW4

Prerequisite: PHYS2031

As for PHYS3110 Experimental Physics B1.

PHYS3410**Biophysics***Staff Contact: Executive Assistant*

U.5 S2 HPW2

Prerequisites: PHYS2011, PHYS2410

Physics of selfassembling 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*

U.5 S1 HPW2

Note/s: Offered in oddnumbered 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.

Psychology

PSYC7104

Applied Cognitive Psychology

Staff Contact: Dr H Stanislaw

S1 HPW2

Cognitive factors that limit our ability to process information, methods used to cope with these limitations, and the implications for such practical areas as training and artificial intelligence. Topics include memory, reasoning and problemsolving, and performance on motor tasks.

PSYC7110

Advanced Ergonomics

Staff Contact: Mr R Hall (Dept. of Safety Science)

S2 HPW3

Application of ergonomic principles and methods to the design and analysis of work tasks involving a high cognitive component, such as those involving humancomputer interaction.

Surveying

SURV0441

Surveying for Engineers

Staff Contact: School Office

S2 L2 T2.5

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

Principles of surveying; coordinate systems, levelling, linear and angular measurement. Traversing, tacheometry and electronic distance measurement. Areas and Volumes. Horizontal and vertical curves. Control, underground and construction surveys. Outline of photogrammetry.

SURV0580

Mining Surveying

Staff Contact: School Office

S1 L2 T1

Prerequisite: SURV0441

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

Revision of traverse, set out and levelling (14 hours field work).

Surface surveys. Map projections, the Integrated Survey Grid (I.S.G.). Electronic Distance Measurement. Correlation of surface surveys with I.S.G. Subsidence. Shaft plumbing. Transfer of height and coordinates. Transfer of azimuth. Gyrotheodolite. Underground mapping. Dip, fault and three dimensional coordinate calculations. Borehole surveying.

SURV9211

Introduction to Geodesy

Staff Contact: School Office

C3 S1 L2 T1

Geodesy in the service of mankind. The earth's gravity field. The earth's motion in space. Coordinate and time systems used in geodesy. Horizontal and vertical control networks. Earth satellite motion. Principles of satellite positioning. Gravimetric geodesy. Space geodetic methods. Variations of geodetic positions with time.

SURV9213

Physical Meteorology

Staff Contact: School Office

C3 S2 L2 T1

Electromagnetic wave propagation, geometrical optics approximation, emission and transfer of radiation. Structure of the earth's atmospheric envelope, surface layer and boundary layer meteorology, structure of the ionosphere, atmospheric turbulence, meteorological measurements. Interaction and propagation of electromagnetic radiation. Refraction, scattering, absorption, dispersion, reflection. Description, models and solutions of geodetic refraction effects. Atmospheric effects on remote sensing (visible, infrared and microwaves). Remote sensing of atmospheric parameters.

SURV9532

Data Acquisition and Terrain Modelling

Staff Contact: School Office

C3 SS L2 T1

Introduction to principles of Computer Assisted Mapping. Collection and editing of feature coded digital terrain data in vector and raster form. Digital elevation models; acquisition, interpolation and processing. Terrain modelling and display. Automation of mapping processes. Archival of digital map data.

SURV9600

Principles of Remote Sensing

Staff Contact: School Office

C3 S1 L2 T1

History and development. Definition and physics of basic electromagnetic radiation quantities. Basic energy matter relationship. Spectral signatures of surfaces. Atmospheric considerations and the reduction of atmospheric effects. Sensor concepts including film and electrooptical sensors. An introduction to data processing and enhancement, including image interpretation procedures.

SURV9602

Remote Sensing Procedures

Staff Contact: School Office

C3 S2 L2 T1

Review of atmospheric correction procedures and application to 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.

SURV9604**Land Information Systems***Staff Contact: School Office*

C3 SS L2 T1

Land information as maps and records. Methods of data collection. Integrated surveys and coordinate systems. Legal boundaries. Land tenure. Identifiers. Computerization of land information. Data input methods. Data storage methods. Data processing and manipulation, including management, searching, existing data base languages, and interactive data editing. Data output, including computer graphics, line printer maps, and digital plotters. Application of ArcInfo LIS software.

SURV9605**Field Data Collection and Integration***Staff Contact: School Office*

C3 S1 HPW3

The spectral, temporal and spatial characteristics of various surfaces, and the available sensors to effect maximum differentiation. Ground and image comparisons. Instruments available for field measurements. Field investigation procedures including positioning and sampling considerations.

SURV9606**Microwave Remote Sensing***Staff Contact: School Office*

C3 S1 HPW3

Use of passive and active (radar) microwave techniques in remote sensing of earth resources. Topics include: real and synthetic aperture radar systems; passive microwave radiometry; energysurface interactions; interpretation of microwave image data: applications in agriculture, geology, oceanography and hydrology; issues in signal and image processing; characteristics of airborne and spaceborne microwave sensors.

SURV9608**Cadastral Systems***Staff Contact: School Office*

C3 SS L2 T1

The cadastral concept. Cadastral surveying and mapping, land registration, valuation of land, land tenure and land administration. Cadastres and land information systems (L.I.S.). Strategies for improving cadastral systems. Cadastral systems in developing countries; legal, technical, administrative, economic and social issues.

Town Planning

PLAN0911**The Organization of Town Planning***Staff Contact: School Office*

SS

Aims, means and consequences of town planning in Australia. Aims of planning: organization of the environment in respect of space and time, interrelationship of functions, equity of resource distribution, human satisfaction, the nature of the planning approach. Means of planning: overview of the planning process, laws related to planning, planning assessment procedures, environmental management at different levels, decisionmaking processes — financiers', firms' and private decisions, changes in public values, public participation, political and economic constraints. Consequences of planning: illustrative case studies, evaluation of planning methodology and procedures.

Conditions for the Award of Degrees

First Degrees

Rules, regulations and conditions for the award of *first degrees* are set out in the appropriate *Faculty Handbooks*.

For the full list of undergraduate courses and degrees offered see *Table of Courses by Faculty (Undergraduate Study)* in the *Calendar*.

The following is the list of *higher degrees, graduate diplomas and graduate certificates of UNSW*, together with the publication in which the conditions for the award appear.

Higher Degrees

For details of graduate degrees by research and course work, arranged in faculty order, see *UNSW Courses (by faculty)* in the *Calendar*.

Title	Abbreviation	Calendar/Handbook
Higher Degrees		
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Education	EdD	Professional Studies
Doctor of Medicine	MD	Medicine
Doctor of Philosophy	PhD	Calendar and all handbooks
Master of Applied Science	MAppSc	Applied Science
Master of Architecture	MArch	Built Environment
Master of Archives Administration	MArchivAdmin	Professional Studies
Master of Art	MArt	College of Fine Arts
Master of Arts Administration	MArtAdmin	College of Fine Arts
Master of Art Education	MArtEd	College of Fine Arts
Master of Arts	MA	Arts and Social Sciences University College
Master of Arts (Honours)	MA(Hons)	Arts and Social Sciences
Master of Art Theory	MArtTh	College of Fine Arts
Master of Biomedical Engineering	MBiomedE	Engineering
Master of Building	MBuild	Built Environment

Title	Abbreviation	Calendar/Handbook
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 Cognitive Science	MCogSc	Engineering
Master of Commerce (Honours)	MCom(Hons)	Commerce and Economics
Master of Commerce	MCom	Commerce and Economics
Master of Community Health	MCH	Medicine
Master of Computer Science	MCompSc	Engineering
Master of Construction Management	MConstMgt	Built Environment
Master of Couple and Family Therapy	MCFT	—
Master of Defence Studies	MDefStud	University College
Master of Education	MEd	Professional Studies
Master of Education in Creative Arts	MEdCA	Professional Studies
Master of Education in Teaching	MEdTeach	Professional Studies
Master of Educational Administration	MEdAdmin	Professional Studies
Master of Engineering	ME	Applied Science
		Engineering
		University College
Master of Engineering <i>without supervision</i>	ME	Applied Science
		Engineering
Master of Engineering Science	MEngSc	Engineering
		Applied Science
		University College
Master of Environmental Engineering Science	MEnvEngSc	Engineering
Master of Environmental Studies	MEnvStudies	Applied Science
Master of Equity and Social Administration	MEqSocAdmin	—
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 Science	MInfSc	Engineering
Master of International Social Development	MIntSocDev	—
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 Optometry	MOptom	Science*
Master of Paediatrics	MPaed	Medicine
Master of Policy Studies	MPS	Arts and Social Sciences
Master of Project Management	MProjMgt	Built Environment
Master of Public Health	MPH	Medicine
		Professional Studies
Master of Psychological Medicine	MPM	Medicine

Title	Abbreviation	Calendar/Handbook
Master of Psychology (Applied)	MPsychol	Science†
Master of Psychology (Clinical)	MPsychol	Science†
Master of Psychotherapy	MPsychotherapy	Medicine
Master of Real Estate	MRE	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 <i>without supervision</i>	MSc	Applied Science
		Built Environment
		Engineering
Master of Science (Industrial Design)	MSc(IndDes)	Built Environment
Master of Science and Society	MScSoc	Arts and Social Sciences
Master of Social Work	MSW	Professional Studies
Master of Sports Science	MSPSc	Professional Studies
Master of Sports Medicine	MSPMed	Medicine
Master of Statistics	MStats	Science*
Master of Surgery	MS	Medicine
Master of Surveying	MSurv	Engineering
Master of Surveying <i>without supervision</i>	MSurv	Engineering
Master of Surveying Science	MSurvSc	Engineering
Master of Taxation	MtAX	ATAX
Master of Town Planning	MTP	Built Environment

Graduate Diplomas

Graduate Diploma	GradDip	AGSM
		Applied Science
		Architecture
		Arts and Social Sciences
		Commerce and Economics
		Engineering
		Medicine
		Professional Studies
		Science*†
	GradDipC/F Therapy	Professional Studies
	GradDipClinEd	Medicine
	GradDipHPed	Medicine
	GradDipHEd	Professional Studies
	GradDipIndMgt	Engineering
	GradDipPaed	Medicine
	GradDipSpMed	Medicine
	DipEd	Professional Studies
	DiplM-ArchivAdmin	Professional Studies
	DiplM-Lib	Professional Studies
	DipFDA	Science*

Graduate Certificates

GradCertPhilT	Arts and Social Sciences
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

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor with Honours from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment as a candidate for the degree.

Enrolment

3. (1) An application to enrol as a candidate for the degree shall be lodged with the Registrar at least one month prior to the date at which enrolment is to begin.

(2) In every case before making the offer of a place the Committee shall be satisfied that initial agreement has been reached between the School* and the applicant on the topic area, supervision arrangements, provision of adequate facilities and any coursework to be prescribed and that these are in accordance with the provisions of the guidelines for promoting postgraduate study within the University.

(3) The candidate shall be enrolled either as a full-time or a part-time student.

(4) A full-time candidate will present the thesis for examination no earlier than three years and no later than five years from the date of enrolment and a part-time candidate will present the thesis for examination no earlier than four years and no later than six years from the date of enrolment, except with the approval of the Committee.

(5) The candidate may undertake the research as an internal student i.e. at a campus, teaching hospital, or other research facility with which the University is associated, or as an external student not in attendance at the University except for periods as may be prescribed by the Committee.

(6) An internal candidate will normally carry out the research on a campus or at a teaching or research facility of the University except that the Committee may permit a candidate to spend a period in the field, within another institution or elsewhere away from the University provided that the work can be supervised in a manner satisfactory to the Committee. In such instances the Committee shall be satisfied that the location and period of time away from the University are necessary to the research program.

(7) The research shall be supervised by a supervisor and where possible a 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 interdisciplinary unit within a faculty and under the control of the Dean of the Faculty. Enrolment is permitted in more than one such teaching unit.*

(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 three 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 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 has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.
- (2) 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.

**Or department where a department is not within a school, or schools or departments where the research is being undertaken in more than one school or department.*

(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 30 credits. The number of credits allocated for each subject shall be determined by the Committee on the recommendation of the appropriate head of school.

(4) A candidate's proposed program shall be approved by the appropriate head of school prior to enrolment. For the purposes of this requirement the appropriate head of school shall normally be the head of the school providing the major field of study.

(5) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(6) No candidate shall be awarded the degree until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate and eight sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

18 Credit Project Report

4. (1) A candidate who undertakes an 18 credit project shall carry out the work on an approved topic under the direction of a supervisor appointed from the full-time academic members of the University staff.

(2) The candidate shall give in writing to the Registrar two months notice of intention to submit a project report.

(3) The project report or thesis shall present an account of the candidate's own research. In special cases work done jointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the project report or thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of project reports and theses for higher degrees.

(6) It shall be understood that the University retains the three copies of the project report or thesis submitted for examination and is free to allow the project report or thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the project report or thesis in whole or in part, in microfilm or other copying medium.

Examination of 18 Credit Project Report

5. (1) There shall be not fewer than two examiners of the project report, appointed by the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the project report and shall recommend to the Committee that:

(a) the project report be noted as satisfactory; or

(b) the project report be noted as satisfactory subject to minor corrections being made to the satisfaction of the head of the school; or

(c) the project report be noted as unsatisfactory but that the candidate be permitted to resubmit it in a revised form after a further period of study and/or research; or

(d) the project report be noted as unsatisfactory and that the candidate be not permitted to resubmit it.

(3) The Committee shall, after considering the examiners' reports and the candidate's results of assessment in the prescribed formal subjects, recommend whether or not the candidate may be awarded the degree. If it is decided that the project report 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 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 lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the degree shall be required to undertake such formal subjects and pass such assessment as prescribed. The program of advanced study shall total a minimum of 45 credits. The number of credits allocated 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

18 Credit Project Report

4. (1) The program of advanced study may include an 18 credit 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 18 Credit Project Report

5. (1) There shall be not fewer than two examiners of the project report, appointed by the Committee.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the project 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 prescribe, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the diploma shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the diploma shall be required to undertake such formal subjects and pass such assessment as prescribed.

(3) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the diploma until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate and six sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

Fees

4. A candidate shall pay such fees as may be determined from time to time by the Council.

Scholarships and Prizes

The scholarships and prizes listed below are available to students whose courses are listed in this book. Each faculty handbook contains in its **Scholarships and Prizes** section the scholarships and prizes available with that faculty. The **General Information** section of the Calendar contains a comprehensive list of scholarships and prizes offered throughout the University. Applicants should note that the awards and conditions are subject to review.

Key: **V** Value **T** Year/s of Tenure **C** Conditions

Scholarships

Undergraduate Scholarships

Listed below is an outline in summary form of undergraduate scholarships available to students. Full information may be obtained from the Student Centre located on the Lower Ground Floor of the Chancellery.

Unless otherwise indicated in footnotes, applications for the following scholarships should be made to the Registrar and Deputy Principal by 14 January each year. Please note that not all of these awards are available every year.

General

Australian Development Corporation

- V** Tuition fees. Some students may be eligible for airfares and a stipend.
- T** Determined by normal course duration
- C** Information should be obtained from Australian Diplomatic Posts. Conditions and entitlements vary depending on the home country. The closing date is normally early in the year before the year of study.

Sam Cracknell Memorial

- V** Up to \$1500 pa payable in fortnightly instalments
- T** 1 year

- C** Prior completion of at least 2 years of a degree or diploma course and enrolment in a full-time course during the year of application; academic merit; participation in sport both directly and administratively; and financial need.

Girls Realm Guild

- V** Up to \$1500 pa
- T** 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need
- C** Available only to female students under 35 years of age who are permanent residents of Australia enrolling in any year of a full-time undergraduate course on the basis of academic merit and financial need.

W.S. and L.B. Robinson

- V** Up to \$6500 pa
- T** 1 year renewable for the duration of the course subject to satisfactory progress
- C** Available only to students who have completed their schooling in Broken Hill or whose parents reside in Broken Hill; for a course related to the mining industry. Includes courses in mining engineering, geology, electrical and mechanical engineering, metallurgical process engineering, chemical engineering and

science. Applications close 30 September each year. Apply directly to PO Box 460 Broken Hill NSW 2880

Alumni Association

- V** Up to \$1500 pa
- T** 1 year with the possibility of renewal
- C** Available to students enrolled in any year of a full-time course. Candidates must be the children of Alumni of the University of NSW and may be either permanent residents of Australia or international students.

Sporting Scholarships

- V** \$2000 pa
- T** 1 year with possibility of renewal
- C** Available to students who are accepted into a course of at least two years duration. Prospective applicants should have an outstanding ability in a particular sport and are expected to be an active member of a UNSW Sports Club. Apply directly to Sport and Recreation Section, The University of New South Wales, Kensington NSW 2052.

General Accident Australian Bicentennial St Andrews Scholarship

- V** £Stg4840
- T** approximately 12 months
- C** Applicants should be Australian citizens who are proceeding to Honours in Economics, History, Philosophy, Economic and Social History or Social Anthropology. The awards are for study at St Andrews, United Kingdom.

Applied Science

Malcolm Chalkin Foundation Scholarship

- V** Up to \$8000 pa
- T** 1 year renewable for the duration of the course subject to satisfactory progress
- C** Permanent residence in Australia. 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.

Applied Bioscience **Food Science and Technology**

Coca-Cola South Pacific Export Corporation

- V** Up to \$1500 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 eligibility for admission to Year 1 of the full-time degree course in Food Technology.

Petroleum Engineering

Society of Petroleum Engineers Pty Ltd

- V** Up to \$2500
- C** Permanent residence in Australia living in specified state and must have completed the first two years of any accredited engineering program normally in that state

Materials Science and Ceramic Engineering **Materials**

Australian 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 or Year 2 of the full-time degree course in Ceramic Engineering

Caroma Industries 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

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 \$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

The Thomson Family

- 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

Zacuba Pty Ltd

- V** Up to \$500 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

Metallurgy

Sir Rupert Myers

- V** Up to \$2500 pa
- T** 1 year renewable for the duration of the course subject to satisfactory progress
- C** Open to students whose parents are permanent residents of Australia or who are themselves permanent residents and who are eligible for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Engineering

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

Mines

The Charles Warman Scholarship

- V** \$4000 pa
- T** 1 year renewable subject to satisfactory progress
- C** Permanent residence in Australia and enrolled in any year of the full-time degree course in Mineral Engineering

Minproc

- V** \$3500 pa
- T** 1 year renewable for the duration of the course subject to satisfactory progress
- C** Available to a student entering the degree course Chemical Engineering (Minerals) or who plans to enrol in the combined BE BSc degree course in Chemical and Minerals Engineering

Wool and Animal Science

Merck, Sharp and Dohme

- V** Up to \$500 pa
- T** 1 year renewable for the duration of the course subject to satisfactory progress
- C** Eligibility for admission to the full-time degree course in Wool and Pastoral Sciences

Dalgety Farmers Bicentennial

- V** Up to \$2500 pa
- T** 1 year renewable for the duration of the course subject to satisfactory progress
- C** Eligibility for admission to the full-time degree course in Wool and Pastoral Sciences

The UNSW Co-op Program

The University of New South Wales has industry-linked education scholarships to the value of \$9600 per annum in the following areas: Accounting (and Economics, Finance, Information Systems or Japanese Studies); Business Information Technology, Aerospace, Bioprocess, Ceramic, Chemical, Civil, Electrical, Environmental, Materials, Mechanical, Metallurgical, Mineral, Mining and Petroleum Engineering; Food Science and Technology, Industrial Chemistry, Manufacturing Management, Textile Management, Textile Technology, and Wool and Pastoral Science.

Graduate Scholarships

Listed below is an outline in summary form of Graduate Scholarships available to students. Application forms and further information are available from the Scholarships Unit and Student Centre, located on the Ground Floor of the Chancellery, unless an alternative contact address is provided. **Normally applications become available four to six weeks before the closing date.**

The following publications may also be of assistance: 1. *Awards for Postgraduate Study in Australia and Awards for Postgraduate Study Overseas*, published by the Graduate Careers Council of Australia. PO Box 28, Parkville, Victoria 3052;* 2. *Study Abroad*, published by UNESCO;*.

Details of overseas awards and exchanges administered by the Department of Employment, Education and Training can be obtained from: Awards and Exchanges Section, Department of Employment, Education and Training, PO Box 826, Woden, ACT 2606.

Where possible, the scholarships are listed in order of faculty. Applicants should note that the awards and conditions are subject to review.

*Available for reference in the University Library.

General

Australian Awards for Research in Asia (AARA)

T 3 to 12 months

C The awards are for postgraduate study or fieldwork in Cambodia, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Sri Lanka, Taiwan, Thailand and Vietnam. Applicants must be Australian citizens, or have Permanent Resident status, and have lived in Australia for the 12 months prior to the close of applications on 30 June.

Caltex National Scholarship for Women

V \$50,000 over two years

T Up to 2 years

C Applicants must be Australian citizens or have resided continuously in Australia for 5 years and have completed, or will complete, in 1994 an award from an Australian institution. Applicants may be proposing to undertake study in any discipline overseas. Application to the Honorary Secretary, Caltex National Scholarship, University by 17 September.

Kobe Steel Scholarship for Postgraduate Study at St Catherine's College, Oxford University

V £14,520

T Up to 2 years

C Applicants must be Australian nationals. Applications close on 31 October with Kobe Steel Australia P/L (Level 32 Gateway, 1 Macquarie Place, 2000).

University Postgraduate Research Scholarships

T 1-2 years for a Masters and 3-4 years for a PhD degree

V Living allowance of \$14,474 pa. Other allowances may also be paid. Tax free.

C Applicants must be honours graduates or equivalent in the Medicine or Commerce faculties, or the University College, Australian Defence Force Academy. A limited number of scholarships are offered subject to the availability of funds. Information should be obtained from the Faculty office.

Australian Postgraduate Awards

T 1-2 years for a Masters and 3-4 years for a PhD degree

V \$11,687 to \$18,679 (1993 rates). Other allowances may also be paid. Tax free.

C Applicants must be honours graduates or equivalent or scholars who will graduate in current academic year, and who are domiciled in Australia. Applications to Registrar by 31 October.

John Crawford Scholarship Scheme

V Tuition fees. Some students may be eligible for air fares and a stipend.

T Determined by normal course duration

C Information should be obtained from Australian Diplomatic Posts. Conditions and entitlements vary depending on the home country.

Overseas Postgraduate Research Scholarships

V Tuition fees only

T 2 years for a Masters and 3 years for a PhD degree

C Eligibility is confined to postgraduate research students who are citizens of countries other than Australia or New Zealand. Applications to the Registrar by 30 September.

Australian American Educational Foundation Fulbright Award

V \$11,500 pa and travel expenses

T 1 year, renewable

C Applicants must be graduates who are domiciled in Australia and wish to undertake research or study for a higher degree in America. Applications close 30 September with The Secretary, DEET, AAEF Travel Grants, PO Box 826, Woden, ACT 2606. Application forms are available from the Associate Registrar, University of Sydney, NSW 2006, telephone (02) 692 2222.

Australian Federation of University Women

V Amount varies, depending on award

T Up to 1 year

- C** Applicants must be female graduates who are members of the Australian Federation of University Women. Further enquiries may be directed to the Secretary of the Federation, (telephone (02) 232 5629).

Commonwealth Scholarship and Fellowship Plan

- V** Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.
- T** Usually 2 years, sometimes 3
- C** Applicants must be graduates who are Australian citizens and who are not older than 35 years of age. Tenable in Commonwealth countries other than Australia. Applications close with the Registrar in early October.

The English-Speaking Union (NSW Branch)

- V** \$8000
- T** 1 year
- C** Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia. Applications close mid-April with The Secretary, Ground Floor, School of Arts, 275c Pitt Street, Sydney, NSW 2000.

Frank Knox Memorial Stipend of Fellowships

- V** \$US11,500 pa plus tuition fees
- T** up to 2 years tenable at Harvard University
- C** Applicants must be British subjects and Australian citizens, who are graduates or near graduates of an Australian university. Applications close with the Academic Registrar mid-October.

Robert Gordon Menzies Scholarship to Harvard

- V** Up to \$US 25,000
- T** 1 year
- C** Tenable at Harvard University. Applicants must be Australian citizens and graduates of an Australian tertiary institution. Applications close 31 December with the Registrar, A.N.U., GPO Box 4, Canberra, ACT 2601

Gowrie Scholarship Trust Fund

- V** \$6000 pa. Under special circumstances this may be increased.
- T** 2 years
- C** Applicants must be members of the Forces or children of members of the Forces who were on active service during the 1939-45 War. Applications close with the Academic Registrar by 31 October.

Harkness Fellowships of the Commonwealth Fund of New York

- V** Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA

- T** 12 to 21 months

- C** Candidates must be Australian citizens and 1. Either members of the Commonwealth or a State Public Service or semi-government Authority. 2. Either staff or graduate students at an Australian university. 3. Individuals recommended for nomination by the Local Correspondents. The candidate will usually have an honours degree or equivalent, or an outstanding record of achievement, and be not more than 35 years of age. Applications close 30 September with the Academic Registrar. Forms available from Mr J. Larkin, Bureau of Agriculture and Resource Economics, GPO Box 1563, Canberra, ACT 2601.

The Packer, Shell and Barclays Scholarships to Cambridge University

- V** Living and travel allowances, tuition expenses
- T** 1-3 years
- C** Applicants must be Australian citizens who are honours graduates or equivalent, and under 26 years of age. Applications are available from The Secretary, Cambridge Commonwealth Trust, PO Box 252, Cambridge CB2 1TZ, England. The scholarship closes on 15 October.

The Rhodes Scholarship to Oxford University

- V** Approximately \$15,000 pa and fees
- T** 2 years, may be extended for a third year.
- C** Unmarried Australian citizens aged between 19 and 25 who have an honours degree or equivalent. Applications close in September each year with The Secretary, University of Sydney, NSW 2006.

Applied Science

Dairy Research and Development Corporation (DRDC) Postgraduate Education Scholarships

- V** Between \$16,000 and \$23,000 pa depending on the applicants level of academic achievement
- C** Applicants must be Australian citizens or Permanent Residents. All applicants must be intending to remain in Australia after completing their studies. Applications close with the DRDC in October. Contact the DRDC (telephone 03 8890577) for more information.

Energy Research and Development Corporation (ERDC) Postgraduate Awards

- V** \$20,000 pa, tax free
- T** Up to 3 years
- C** ERDC awards are based on academic excellence or a proven track record of excellence in research which indicates potential to contribute to the energy industry. Contact ERDC Postgraduate Award (06 2744804) for an application. Applications close 30 September.

Meat Research Corporation (MRC) Studentship

V \$14,260 for study in Australia or \$US17,500 for study overseas. A dependants allowance 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 30 September.

Pig Research Council Study/Training Awards

Applications close 1 December with the Pig Research and Development Corporation, PO Box 4804, Kingston, ACT 2604 (telephone: 062725139)

Rural Industries Research and Development Corporation (RIRDC) Postgraduate Scholarships

V \$21,000 pa plus allowances

T Up to 3 years

C Applicants must be Australian citizens or Permanent Residents. Applications close 6 November with the RIRDC, PO Box 4776, Kingston ACT 2604.

Sir Robert Gordon Menzies Memorial Scholarship in Earth Sciences for Study in the United Kingdom

V £15,000 pa, tax free. Air fare and additional allowances may be payable.

T Up to 3 years

C Applicants should be aged between 21 and 35 and be Australian citizens with at least 5 years standing as residents. Applications are available from the Scholarships Unit. Applications close on 30 June with Sir Robert Gordon Menzies Foundation, "Clarendon Terrace", 210 Clarendon St, East Melbourne, Vic 3002.

Sugar Research and Development Corporation (SRDC) Postgraduate Scholarships

• Applications and information are available from the SRDC, PO Box 12050, Brisbane, Elizabeth St, Q4002, Australia. Applications close 30 September.

Wool Research and Development Corporation (WRDC) Postgraduate Scholarships

V \$21,362 pa (taxable)

T Up to 4 years subject to satisfactory progress

C Tenable in Australian tertiary institutions or overseas in exceptional circumstances. Enquiries to the School of Fibre Science and Technology. Applications close early September with the WRDC, GPO Box 5343BB, Melbourne Vic 3001 (telephone: 03 3419184)

Land and Water Resources Research and Development Corporation (LWRRDC)

V \$20,000 pa

T 2-4 years

C Applications close with the LWRRDC on 30 July.

Prizes

Undergraduate University Prizes

The following information summarizes undergraduate prizes awarded by the University. Prizes which are not specific to any School are listed under General. All other prizes are listed under the Faculty or Schools in which they are awarded.

Information regarding the establishment of new prizes may be obtained from the Examinations Section located on the Ground Floor of the Chancellery.

General**The Sydney Technical College Union Award**

V \$400.00 and Bronze Medal

C Leadership in student affairs combined with marked academic proficiency by a graduand

The University of New South Wales Alumni

V Statuette Association Prize

C Achievement for community benefit by a student in the final or graduating year

School of Applied Bioscience**Food Science and Technology****The Cottee's Foods Prize**

V \$500.00

C The best performance in FOOD1420 Food Legislation in the Bachelor of Science in Food Technology degree course

The Nestlé Australia Pty Limited Prize**V** \$200.00

- C** The best performance in FOOD1400 Project in the Bachelor of Science in Food Science and Technology degree course

The Wilfred B.S. Bishop Prize**V** \$75.00

- C** The best overall performance in the Bachelor of Science Degree in Food Science and Technology degree course by a student who has made a significant contribution to staff and student activities

Biotechnology**The Amersham Modern Techniques in Biotechnology Prize****V** \$250.00

- C** The best performance in BIOT3061 Monoclonal Antibody and Genetic Techniques in Biotechnology

The Burns Philp Food Prize**V** \$175.00

- C** The best performance in BIOT3100 Fermentation Processes in the Bachelor of Science degree course

The Burns Philp Food Prize**V** \$175.00

- C** The best performance in one of the Level 3 Biotechnology subjects
- BIOT3011 Biotechnology A
 - BIOT3021 Biotechnology B
 - BIOT3031 Microbial Genetics
 - BIOT3061 Monoclonal Antibody and Genetic Techniques in Biotechnology
- by a student in the Bachelor of Science degree course

The Burns Philp Food Prize**V** \$175.00

- C** The best overall performance in the Bachelor of Science degree course in Biotechnology at honours level

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 years membership of the Association

- C** The best performance in INDC3042 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 CHEN3070 Instrumentation and Process Control 1 in the Chemical Engineering course

The Australian Paper Manufacturers Ltd Prize**V** \$200.00

- C** The best performance in CHEN3070 Instrumentation and Process Control 1 in the Industrial Chemistry course

The CSR Limited Prize**V** \$100.00

- C** The best performance in a subject selected by the Head of School

The Fuel Technology Staff Prize**V** \$200.00

- C** The best performance in a subject selected by the Head of School

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 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 courses including sporting and student activities

The Shell Prize

V \$100.00

- C** The best performance by a student in Year 3 or equivalent part-time stage of the Chemical Engineering or Industrial Chemistry courses including sporting and student activities

The Shell Prize

V \$100.00

- C** The best performance by a student in Year 4 or equivalent part-time stage of the Chemical Engineering or Industrial Chemistry courses 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 Shell Prize

V \$200.00

- C** The best performance in a subject selected by the Head of School

The Simon-Carves Australia Prize

V \$100.00

- C** The best performance in CHEN3010 or INDC3010 Thermodynamics

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

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 subjects by a student in the Bachelor of Science degree course in Textile Technology or Textile Management

Wool and Animal Science

The Bayer Animal Health Prize

V \$120.00

- C** The best performance in Years 2 and Year 3 of a degree course in Wool and Pastoral Science

The C.R. Luckock Prize

V Book or \$60.00 voucher drawn on University Co-op Bookshop

- 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 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

The P.R. McMahon Memorial Prize

V \$100.00

- C** Excellence in Wool Science in the Bachelor of Science degree course in Wool and Pastoral 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 in Applied Science

The Jack Mabbutt Prize

- V** \$150.00
- C** Best performance by a Year 3 student proceeding to the award of honours in Geography

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 in Ceramic Engineering course

The ANSTO Prize

- V** \$100.00
- C** The best performance in year four in the Bachelor of Engineering in Ceramic Engineering course

The Alcan Australia Ltd Prize

- V** \$200.00
- C** The best performance in a subject selected by the Head of School

The Austral Bricks Prize

- V** \$100.00
- C** The best performance in year three in the Bachelor of Engineering in Ceramic Engineering course

The Australasian Corrosion Association (NSW)

- V** \$150.00
- C** The best performance in MATS1203 Materials & Design 2 by a student in the Bachelor of Metallurgical Engineering degree course

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 Boral Bricks Prize

- V** \$500.00
- C** The best performance in MATS2173 Chemistry of Ceramic Processing, Unit 2, Technical and Non-Technical Ceramics in the Bachelor of Engineering in Ceramic Engineering course

The Broken Hill Proprietary Company Prize

- V** \$1,000.00
- C** The best performance in Metallurgical Engineering course by a graduating student

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 in Ceramic Engineering course

The Commercial Minerals Limited Prize

- V** \$200.00
- C** The best performance in MATS2133 Ceramic Raw Materials in the Bachelor of Engineering in Ceramic Engineering course

The Cookson Plimbrico Prize

- V** \$350.00
- C** The best performance in MATS2173 Chemistry of Ceramic Processing, Unit 1, Refractories in the Bachelor of Engineering in Ceramic Engineering course

The Ferro Corporation (Australia) Prize

- V** \$250.00
- C** The best performance in MATS2123 Ceramic Process Principles 2 in the Bachelor of Engineering in Ceramic Engineering course

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 in Ceramic Engineering course

The Institute of Metals and Materials Australasia Prize

- V** \$200.00 and 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 Physio-Chemical Ceramics Laboratory with each subject receiving one half of the weighting for the average, by a student in the Bachelor of Engineering in Ceramic Engineering course

The Max Hatherly Prize

V \$275.00

- C** The best performance in the final year practical examination or for an outstanding performance in Metallography

The Monier PGH Prize

V \$1,000.00

- C** The best performance by a graduating student in the Bachelor of Engineering in Ceramic Engineering course

The Morganite Ceramic Fibres Pty Ltd Prize

V \$200.00

- C** The best performance in MATS2254 Ceramic Engineering Design by a student in the Bachelor of Engineering in Ceramic Engineering course.

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 degree of Bachelor of Engineering in Ceramic Engineering

The Taylor Ceramic Engineering Prize

V \$100.00 & plaque

- C** The greatest overall amount of ingenuity shown in professional activities by a graduating student in the Bachelor of Engineering in Ceramic Engineering course

The Wallarah Minerals Prize

V \$100.00

- C** The best performance 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 to the value of \$200.00 + 1 years Membership of the Institute

- C** The best performance in MATS4384 Welding Science and Technology

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) courses in Materials Science and Engineering

The Western Mining Corporation Ltd Prize

V \$150.00

- C** The best overall performance in Year 4 full-time (or its part-time equivalent) in the Bachelor of Metallurgical Engineering in Process Metallurgy or Bachelor of Science (Technology) degree courses in Metallurgy

School of Mines

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 Year 3 of the Bachelor of Engineering degree course in Mining Engineering

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 F.C. Loughnan Prize For First Year Geology

V \$150.00

- C** The best performance in year 1 of the Geology component of the Bachelor of Science degree course

The F.C. Loughnan Prize in Applied Geology

V \$150.00

- C** The best performance in Year 3 of the Geology component of the Bachelor of Science degree course

The Lorant Eötvös Prize in Geology**V** \$300.00 & Medal

- C** The best performance in GEOL4111 Advanced Geological Techniques by a final year student in the Bachelor of Science in Applied Geology course or Bachelor of Science with Honours in Applied Geology course

The Prospectors Supplies Prize**V** Brunton Compass

- C** Meritorious performance in GEOL4203 Field Project by a student in Year 4 of the Applied Geology degree course, or equivalent Science and Mathematics degree course at honours level, proceeding to the award of the degree of Bachelor of Science

Graduate University Prizes

The following information summarizes graduate prizes awarded by the University.

Faculty of Commerce and Economics**The Universities Credit Union Prize****V** \$200.00

- C** The best performance by a full-time student in Year 1 of the Master of Commerce degree course

The Universities Credit Union Prize**V** \$200.00

- C** The best performance by a part-time student in Year 1 of the Master of Commerce degree course

Faculty of Applied Science**Safety Science****The Ergonomics Society of Australia (NSW) Prize****V** \$100 and membership of the Society

- C** The best performance in the core subjects of the Graduate Diploma course in Ergonomics

The Manufacturers Mutual Insurance Prize for Ergonomic Principles**V** \$200.00

- C** The best performance in SAFE9224 Principles of Ergonomics by a student proceeding either to the award of the degree of Master of Safety Science or to the Graduate Diploma in Safety Science or to the Graduate Diploma in Ergonomics

The Manufacturers Mutual Insurance Prize for Occupational Disease**V** \$150.00

- C** The best performance in CMED9701 Occupational Disease by a student proceeding either to the award of the degree of Master of Safety Science or to the Graduate Diploma in Safety Science or to the Graduate Diploma in Ergonomics

The Manufacturers Mutual Insurance Prize for Occupational Health and Hygiene**V** \$150.00

- C** The best performance in SAFE9261 Occupational Health and Hygiene by a student enrolled in the Masters degree or Graduate Diploma courses in Safety Science

The National Safety Council of Australia (NSW Division) Prize**V** \$100.00

- C** The best performance in SAFE9211 Introduction to Safety Engineering in the Masters degree or Graduate Diploma courses in Safety Science

The National Starch and 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 Neil Adams Ergonomics Prize**V** \$250.00

- C** Awarded annually to the student enrolled in the Graduate Diploma course in Ergonomics who achieved the best performance in the preceding calendar year considering the students best three subjects during that year, providing at least one of the three subjects was an Ergonomics subject

**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 degree course

**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 course in Safety Science

The Whiteley Chemicals Prize

- V** \$200.00
- C** The best performance in SAFE9263 Chemical Safety and Toxicology by a student in the Diploma or Coursework Masters course in the Department of Safety Science

School of Applied Bioscience

Biotechnology

The Burns Philp Foods Prize

- V** \$175.00
- C** The best overall performance in the Master of Applied Science degree course in Biotechnology

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 degrees of Master of Science

or Doctor of Philosophy in the Department of Food Science and Technology

**School of Chemical Engineering and
Industrial Chemistry**

**The Clean Air Society of Australia and New
Zealand Prize in Atmospheric Pollution Control**

- V** \$100.00
- C** The highest aggregate in FUEL5910 Atmospheric Pollution and Control and FUEL5920 Practical Aspects of Air Pollution Measurement and Control in a graduate course in the School of Chemical Engineering and Industrial Chemistry

**School of Fibre Science and
Technology**

Textile Technology

The Malcolm Chaikin Prize

- V** \$200.00 and Bronze Medal
- C** The most outstanding PhD thesis in the Department of Textile Technology

School of Mines

Applied Geology

The Laric V. Hawkins Prize

- V** \$500.00
- C** The best written account of research work in the area of Geophysics in a graduate degree or diploma course

Notes

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**
 Mathews Theatres **D23**
 Parade Theatre **E3**
 Quadrangle Theatre **E15**
 Macauley Theatre (*Main Building*) **K14**
 Rex Vowels Theatre **F17**
 Science Theatre **F13**
 Sir John Clancy Auditorium **C24**
 Webster Theatre **G15**

Buildings

Applied Science **F10**
 Barker Street Gatehouse **N11**
 Bassor College (*Kensington*) **C18**
 Central Store **B13**
 Chancellery **C22**
 Dalton (*Chemistry*) **F12**
 Goldstein College (*Kensington*) **D16**
 Golf House **A27**
 Gymnasium **B5**
 International House **C6**
 John Goodsell (*Commerce and Economics*) **F20**
 Kensington Colleges (*Office*) **C17**
 Library (*University*) **E21**
 Link **B6**
 Maintenance Workshop **B13**
 Mathews **F23**
 Menzies Library **E21**
 Morven Brown (*Arts*) **C20**
 New College **L6**
 Newton **J12**
 NIDA **D2**
 Parking Station **H25**
 Parking Station **N18**
 Philip Baxter College (*Kensington*) **D14**
 Quadrangle **E15**
 Robert Heffron (*Chemistry*) **E12**
 Sam Cracknell Pavilion **H8**
 Samuels Building **F26**
 Shalom College **N9**

Sir Robert Webster **G14**
 Unisearch House **L5**
 University Regiment **J2**
 University Union (*Roundhouse*) **E6**
 University Union (*Blockhouse*) **G6**
 University Union (*Squarehouse*) **E4**
 Wallace Wurth School of Medicine **C27**
 Warrane College **M7**

General

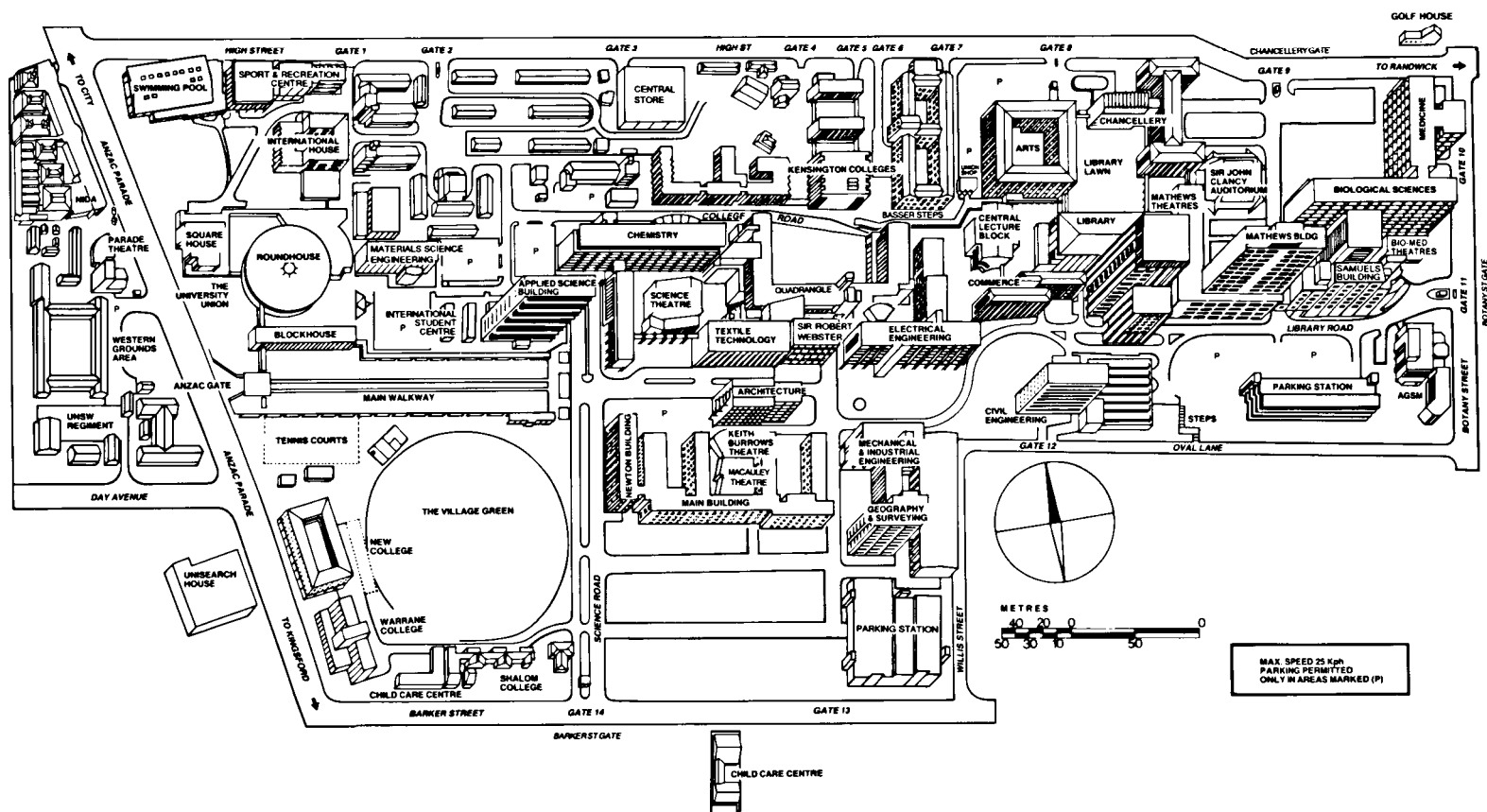
Aboriginal Student Centre:
 47 Botany St, Randwick
 Accommodation (*off-campus*) **E15**
 Accounting **E15**
 Admissions **C22**
 Adviser for Prospective Students **C22**
 Alumni Relations: *Pindari*,
 76 Wentworth St, Randwick
 Anatomy **C27**
 Applied Bioscience **D26**
 Applied Economic Research Centre **F20**
 Applied Geology **F10**
 Applied Science (*Faculty Office*) **F10**
 Archives, University **E21**
 Arts and Social Sciences
 (*Faculty Office*) **C20**
 Asia-Australia Institute:
 34 Botany St, Randwick
 Audio Visual Unit **F20**
 Australian Graduate School
 of Management **G27**
 Banking and Finance **E15**
 Biochemistry and Molecular Genetics **D26**
 Biological and Behavioural Sciences
 (*Faculty Office*) **D26**
 Biomedical Engineering **F25**
 Biomedical Library **F23**
 Biotechnology **F25**
 Built Environment (*Faculty Office*) **H14**
 Campus Services **C22**
 Cashier's Office **C22**
 Chaplains **E4**
 Chemical Engineering and
 Industrial Chemistry **F10**
 Chemistry **E12**
 Civil Engineering **H20**
 Co-op Bookshop **E15**
 Commerce and Economics
 (*Faculty Office*) **E15**
 Communications Law Centre **C15**
 Community Medicine **D26**
 Computer Science and Engineering **G17**
 Computing Services Department **F25**
 Cornea and Contact Lens Research Unit:
 22-32 King St, Randwick
 Economics **F20**
 Education Studies **G2**
 Educational Testing Centre **E4**
 Electrical Engineering **G17**
 Energy Research, Development &
 Information Centre **F10**
 Engineering (*Faculty Office*) **K17**
 English **C20**
 Examinations **C22**
 Fees Office **C22**
 Fibre Science and Technology **G14**
 Food Science and Technology **B8**
 French **C20**
 Geography **K17**
 German and Russian Studies **C20**
 Graduate School of the Built
 Environment **H14**
 Groundwater Management and
 Hydrogeology **F10**
 Health Service, University **E15**
 Health Services Management **C22**
 History **C20**
 House at Pooh Corner (*Child Care*) **N8**
 Human Resources **C22**
 Industrial Design **G14**
 Industrial Relations and
 Organizational Behaviour **F20**
 Information, Library & Archives Studies **F23**
 Information Systems **E15**
 Institute of Languages:
 4 Francis St, Randwick
 International Student Centre **F9**
 IPACE Institute **F23**
 Japanese Economic and
 Management Studies **E15**
 Kanga's House (*Child Care*) **O14**
 Landscape Architecture **K15**
 Law (*Faculty Office*) **F21**
 Law Library **F21**
 Legal Studies & Taxation **F20**
 Liberal and General Studies **C20**
 Lost Property **C22**
 Marine Science **D26**
 Marketing **F20**
 Materials Science and Engineering **E8**

Mathematics **F23**
 Mechanical and Manufacturing
 Engineering **J17**
 Medical Education **C27**
 Medicine (*Faculty Office*) **B27**
 Membrane and Separation Technology **F10**
 Microbiology and Immunology **D26**
 Mines **K15**
 Music and Music Education **B11**
 News Service **C22**
 Optometry **J12**
 Pathology **C27**
 Performing Arts **B10**
 Petroleum Engineering **D12**
 Philosophy **C20**
 Physics **K15**
 Physiology and Pharmacology **C27**
 Political Science **C20**
 Printing Section **C22**
 Professional Development Centre **E15**
 Professional Studies (*Faculty Office*) **G2**
 Property **C22**
 Psychology **F23**
 Publications Section **C22**
 Remote Sensing **K17**
 Safety Science **B9**
 Science (*Faculty Office*) **E12**
 Science and Technology Studies **C20**
 Social Science and Policy **C20**
 Social Policy Research Centre **F25**
 Social Work **G2**
 Sociology **C20**
 Spanish and Latin American Studies **C20**
 Sport and Recreation Centre **B6**
 Squash Courts **B7**
 Student Centre (*off Library Lawn*) **C22**
 Student Services:
 Careers, Loans, Accommodation etc **E15**
 Counselling **E15**
 Students' Guild **E15**
 Students' Union **E15**
 Surveying **K17**
 Swimming Pool **B4**
 Textile Technology **G14**
 Theatre and Film Studies **B10**
 Town Planning **K15**
 UNSW Press: 22-32 King St, Randwick
 WHO Regional Training Centre **C27**
 Wool and Animal Sciences **G14**
 Works and Maintenance **B14A**

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The University of New South Wales, Kensington Campus



This Handbook has been specifically designed as a source of detailed reference information for first year and re-enrolling undergraduate and postgraduate students. Separate handbooks are published for Applied Science, Arts and Social Sciences, Built Environment, Commerce and Economics, Engineering, Law, Medicine, Professional Studies, Science, the Australian Graduate School of Management, College of Fine Arts, University College (ADFA) and the Centre for Liberal and General Studies. For fuller details about the University – its organisation, staff members, description of disciplines, scholarships and prizes and so on, consult the University Calendar (Summary Volume). For further information on student matters consult the University Student Guide.