The University of New South Wales

Applied Science

1991 Faculty Handbook

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Subjects, courses and any arrangements for courses including staff allocated, as stated in the Calendar or any Handbook or any other publication, announcement or advice of the University, are an expression of intent only and are not to be taken as a firm offer or undertaking. The University reserves the right to discontinue or vary such subjects, courses, arrangements or staff allocations at any time without notice.

Information in this Handbook has been brought up to date as at 8 October 1990, but may be amended without notice by the University Council.

Contents

Calendar of Dates

The academic year is divided into two sessions, each containing 67 days 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.

Faculties other than Medicine

	1991	1992
Session 1 (67 teaching days)	4 March to 28 March	2 March to 16 April
Recess:	*29 March to 7 April*	*17 April to 26 April*
	8 April to 14 June	27April to 10 June
Study Recess:	*15 June to 20 June*	*11 June to 16 June*
Examinations	21 June to 9 July	17 June to 3 July
Midyear Recess:	*10 July to 28 July*	*4 July to 26 July*
Session 2 (67 teaching days)	29 July to 27 September	27 July to 25 September
Recess:	*28 September to 7 October*	*26 September to 5 October*
	8 October to 6 November	6 October to 4 November
Study Recess:	*7 November to 12 November*	*5 November to 10 November*
Examinations	13 November to 29 November	11 November to 27 November

Important Dates for 1991

January

T	1	New Year's Day - Public Holiday
Th	3	Last day for acceptance of applications by Office of the Admissions Section for transfer to another undergraduate course within the University.
W	9	Last day for applications for review of assessment
M	14	Term 1 begins - Medicine IV
M	21	Term 1 begins - Medicine V
S	26	Australia Day - Public Holiday

February

T	5	Enrolment period begins for new undergraduate students and undergraduate students repeating first year
M	11	Re-enrolment period begins for second and later year undergraduate and graduate students enrolled in formal courses Students should consult the "Re-enrolling 1991" leaflet for their course for details.

March

F	1	Last day for acceptance of enrolment by new and re-enrolling students. (Late fee payable thereafter if enrolment approved).
M	4	Session 1 begins - all courses except Medicine IV and V
F	15	Last day applications are accepted from students to enrol in Session 1 or whole year subjects.
F	29	Good Friday - Public Holiday
		Mid-session Recess begins
S	30	Easter Saturday - Public Holiday
Su	31	HECS Census Date for Session 1

April

M	1	Easter Monday - Public Holiday
Th	25	Anzac Day - Public Holiday

May

T	14	Publication of Provisional Timetable for June examinations
W	22	Last day for students to advise of examination clashes

June

T	4	Publication of Timetable for June Examination
M	10	Queen's Birthday - Public Holiday
F	14	Session 1 ends
S	15	Study Recess begins
Th	20	Study Recess ends
F	21	Examinations begin

July

T	9	Examinations end
Su	28	Midyear Recess ends
M	29	Session 2 begins

August

F	9	Last day applications are accepted from students to enrol in Session 2 subjects
S	31	HECS census date for Session 2

September

F	27	Closing date for applications to the Universities Admissions Centre
S	28	Mid-session Recess begins

October

M	7	Labour Day - Public Holiday
		Mid-session Recess ends
T	8	Publication of provisional timetable for November Examinations
W	16	Last day for students to advise of examination clashes
T	29	Publication of timetable for November examinations

November

W	6	Session 2 ends
Th	7	Study Recess begins
T	12	Study Recess ends
W	13	Examinations begin
F	29	Examinations end

December

W	25	Christmas Day - Public Holiday
Th	26	Boxing Day - Public Holiday

Foreword

Engineering and science disciplines that are directly concerned with aspects of Australia's resources have been established in the Faculty of Applied Science. Inter-disciplinary 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, and Mines.

Undergraduate courses available are:

- Applied Geology (including specialization in Mineral and Energy Resources, Engineering Geology, and Geophysics)
- Ceramic Engineering
- Chemical Engineering (including Fuel 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)
- Mining Engineering
- Metallurgical Engineering
- Mining Geology
- Petroleum Engineering
- Textile Management
- Textile Technology (including Textile Chemistry, Textile Engineering and Textile Physics)
- Wool and Pastoral Sciences
- Biotechnology, through an honours degree course in the Faculty of Science.

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

The importance of applied science to the University of New South Wales, and to the wider community, is fully 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 programmes underway. The staff are enthusiastic, and I hope that you will share their enthusiasm.

Once the term 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 extra-mural activities of the University, especially in the student societies in the Schools.

The format of this Handbook has been changed this year to make it more useful to you; we would welcome your comments. Also 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

Staff

Comprises Schools of Applied Bioscience, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, and Mines.

Dean
Professor G.J.S. Govett

Chairman
Associate Professor J.P. Kennedy

Executive Officer
John David Collins, BSc PhD *N.S.W*, Ctext, ATI

Senior Administrative Officer
Graham John Baldwin, BA *A.N.U.*

Project Manager
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Officer-in-charge, Drawing Office
Narendra Mohan Saha-Chaudhury, BME *Jadavpur*, MIEInd, MIEAust

Electron Microscope Unit of the Faculty of Applied Science

Physical Sciences Electron Microscopist
Paul Munroe, BSc PhD *Birm.*,

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 L. 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
Miss 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 Professor B. Garner.
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 S. Howard, Administrative Assistant.
Room 49A, Main Building. Tel. 697 4516.

Petroleum Engineering Ms L. Causer, Room 115, Petroleum Engineering Building. Tel. 697 5189.

Textile Technology Mr D. Rose, 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.

Faculty of Applied Science Enrolment Procedures

All students re-enrolling in 1991 should obtain a copy of the free leaflet *Re-Enrolling in 1991* 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.

It is University policy to promote equal opportunity in education (refer to EOE Policy Statement, University of New South Wales *Calendar* and the *Guide for Students 1991*).

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 Building F15 (Careers & Counselling Unit).

Student Clubs and Societies

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

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

Applied Sciences Library Facilities

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

The Biomedical Library

The Biomedical Library provides library services for staff and students from the Faculties of Medicine and Biological Sciences, and from the Schools of Biological Technologies, Health Services Administration and Fibre Science and Technology. 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 CD-ROM; remote access to databases on CD-ROM 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 CD-ROM facilities. Photocopying facilities are also available.

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

Physical Sciences Librarian — Rhonda Langford

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 appropriateschool 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 intergral 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.

The program requires students to undertake studies in three categories of the program:

CATEGORY A. An introduction in non-specialist terms to an understanding of the environments in which humans function.

CATEGORY B. An introduction to, and a critical reflection upon, the cultural bases of knowledge, belief, language, identity and purpose.

CATEGORY C. An introduction to the development, design and responsible management of 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 key questions addressed by the Program are:

CATEGORY A: The External Context

Course requirement: 2x28 hr subjects

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

CATEGORY B: The Internal Context of Assumptions And Values

Course requirement: 2x28 hr subjects.

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

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

CATEGORY C: An Introduction To The Design And Responsible Management Of The Human And Planetary Future

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:

(i) in a creative and innovative way?

(ii) to widen the circle of human participation in the benefits they bring?

(iii) to break down the barriers of exclusion and discrimination?

(iv) to enhance the prospects for survival of the human species?

(v) to enhance the capacity of the planet earth to sustain life?

The exact form in which Category C will be satisfied is still being decided and should be finalized during 1991. This could involve, however, a slight change to the later years of each of the courses. There are differing requirements 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.

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 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

Graduate Enrolment Procedures

All students enrolling in graduate courses should obtain a copy of the free leaflet *Re-Enrolling 1991 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, 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.

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, Food Technology, Mining and Mineral Engineering, Remote 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.

Subject Descriptions

Identification of Subjects

A subject is defined by the Academic Board as 'a unit of instruction approved by the University as being a discrete part of the requirements for a course offered by the University'.

In 1991 a new system of subject identification is introduced. Each approved subject of the University will be identified by a sequence of eight characters, consisting of a four character alphabetical prefix which identifies the organizational unit responsible for administering the subject, and a four digit numeric suffix identifies the subject.

Subject identifiers are approved by the Registrar and the system of allocation is based on the following guidelines:

1. The authority offering the subject, normally a School of the University, is indicated by the four character alphabetical prefix.

2. Each subject identifier is unique and is not used for more than one subject title.

3. Subject numbers which have previously been used are not used for new subject titles.

Subjects taught are listed in full in the handbook of the faculty or board of studies responsible for the particular course within which the subjects are taken. Subject descriptions are contained in the appropriate section in the handbooks.

Appropriate subjects for each school appear at the end of each school section.

The identifying alphabetical prefixes for each organizational unit are set out on the following page.

Servicing Subjects are those taught by a school or department outside its own faculty. Their subject descriptions are published in the handbook of the faculty which originates the subject and are also published in the handbook of the faculty in which the subject is taught. The following pages contain descriptions for most of the subjects offered for the courses described in this book, the exception being General Education subjects. For General Education subjects see the General Education Handbook which is available free of charge.

HSC Exam Prerequisites

Subjects which require prerequisites for enrolment in terms of the HSC Examination percentile range, refer to the 1978 and subsequent Examinations.

Candidates for enrolment who obtained the HSC in previous years or hold other high school matriculation should check with the appropriate school on what matriculation status is required for admission to a subject.

Information Key

The following is the key to the information which may be supplied about each subject:

S1 Session 1, **S2** Session 2

F Session 1 *plus* Session 2, ie full year

S1 or S2 Session 1 or Session 2, ie choice of either session

SS single session, but which session taught is not known at time of publication

CCH class contact hours

L Lecture, followed by hours per week

T Laboratory/Tutorial, followed by hours per week

hpw hours per week

wks weeks of duration

C Credit point value

CR Credit

DN Distinction

HD High Distinction

X External

Prefix	Organizational unit	Faculty
ABIO	School of Applied Bioscience	Applied Science
ACCT	School of Accounting	Commerce & Economics
ACHM	Department of Chemistry	University College
ACMA	Department of Civil Engineering	University College
ACSC	Department of Computer Science	University College
AECM	Department of Economics & Management	University College
AELE	Department of Electrical Engineering	University College
AENG	Department of English	University College
AERO	Aerospace Engineering	Engineering
AGOC	Department of Geography & Oceanography	University College
AHIS	Department of History	University College
AINT	UniversityCollege(Interdisciplinary)	University College
AMAT	Department of Mathematics	University College
AMEC	Department of Mechanical Engineering	University College
ANAT	School of Anatomy	Medicine
APHY	Department of Physics	University College
APOL	Department of Politics	University College
APSE	Faculty of Applied Science	Applied Science
ARCH	School of Architecture	Architecture
ARTS	Faculty of Arts	Arts
ASIA	Asian Studies	Arts
AUST	Australian Studies	Arts
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
BLDG	School of Building	Architecture
BSSM	Board of Studies in Science & Mathematics	
CEIC	School of Chemical Engineering & Industrial Chemistry	Applied Science
CHEM	School of Chemistry	Science
CHEN	Department of Chemical Engineering	Applied Science
CHIN	Chinese	Arts
CIVL	School of Civil Engineering	Engineering
CMED	School of Community Medicine	Medicine
COFA	College of Fine Arts	
COMM	Faculty of Commerce	Commerce & Economics
COMP	Computer Science	Engineering
ECOH	Department of Economic History	Commerce & Economics
ECON	School of Economics, Departments of Econometrics and Economics	Commerce & Economics
EDST	School of Education Studies	Professional Studies
ELEC	School of Electrical Engineering & Computer Science	Engineering
ENGL	School of English	Arts
EURO	European Studies	Arts
EXPA	School of Arts and Music Education	Professional Studies
FIBR	School of Fibre Science & Technology	Applied Science
FINS	School of Banking & Finance	Commerce & Economics
FOOD	Department of Food Science and Technology	Applied Science
FREN	School of French	Arts
FUEL	Department of Fuel Technology	Applied Science
GENS	Centre for Liberal & General Studies	
GEOG	School of Geography	Applied Science
GEOL	Department of Applied Geology	Applied Science
GERS	School of German Studies	Arts
GREK	Modern Greek	Arts
GSBE	Graduate School of the Built Environment	Architecture
HEAL	School of Health Services Management	Professional Studies
HIST	School of History	Arts
HOSP	School of Marketing	Commerce & Economics
IDES	Department of Industrial Design	Architecture
INDC	Department of Industrial Chemistry	Applied Science
INDO	Indonesian	Arts
INFS	School of Information Systems	Commerce & Economics
INTD	Interdisciplinary Studies	Arts
IROB	School of Industrial Relations & Organ. Behaviour	Commerce & Economics
JAPN	School of Marketing	Commerce & Economics
KCME	Key Centre for Mines	Applied Science
LAND	School of Landscape Architecture	Architecture
LAWS	School of Law	Law
LEGT	Department of Legal Studies & Taxation	Commerce & Economics
LIBS	School of Librarianship	Professional Studies
MANF	Manufacturing Management	Engineering
MARK	School of Marketing	Commerce & Economics
MATH	School of Mathematics	Science
MATS	School of Materials Science and Engineering	Applied Science
MDCN	School of Medicine	Medicine
MDSG	Med/Surg.Clinical Studies	Medicine
MECH	School of Mechanical Eng. & Manufacturing Eng.	Engineering
MEED	School of Medical Education	Medicine
MFAC	Medical Faculty (Admin)	Medicine

Prefix	Organizational unit	Faculty
MICR	School of Microbiology	Biological & Behavioural Sciences
MINE	Department of Mining Engineering	Applied Science
MNGT	Australian Graduate School of Management	
MUSI	Department of Music	Arts
NAVL	Naval Architecture	Engineering
OBST	School of Obstetrics & Gynaecology	Medicine
OPTM	School of Optometry	Science
PAED	School of Paediatrics	Medicine
PATH	School of Pathology	Medicine
PHIL	School of Philosophy	Arts
PHPH	School of Physiology & Pharmacology	Medicine
PHYS	School of Physics	Science
PLAN	School of Town Planning	Architecture
POLS	School of Political Science	Arts
POLY	Department of Polymer Science	Applied Science
PSCY	School of Psychiatry	Medicine
PSYC	School of Psychology	Biological & Behavioural Sciences
PTRL	Department of Petroleum Engineering Studies	Applied Science
REMO	Centre for Remote Sensing	Engineering
RUSS	Department of Russian Studies	Arts
SAFE	Centre for Safety Science	Engineering
SCTS\ HPST	School of Science & Technology Studies	Arts
SLSP	Department of Social Science & Policy	Arts
SLST	School of Sport & Leisure Studies	Professional Studies
SOCI	School of Sociology	Arts
SOCW	School of Social Work	Professional Studies
SPAN	Spanish & Latin American Studies	Arts
SURG	School of Surgery	Medicine
SURV	School of Surveying	Engineering
TEDG	School of Teacher Education (grad)	Professional Studies
TEED	School of Teacher Education (undergrad)	Professional Studies
TESL	TESOL	Arts
TEXT	Department of Textile Technology	Applied Science
THST	School of Theatre Studies	Arts
USOM	School of Mines	Applied Science
WOMS	Women Studies	Arts
WOOL	Department of Wool & Animal Science	Applied Science

School of Applied Bioscience

School of Applied Bioscience

Head of School
Professor P. P. Gray

Administrative Assistant
Ms R. Lee

The former Schools of Biotechnology and of Food Science and Technology were amalgamated in January 1986 to form the School of Biological Technologies. The School was renamed the School of Applied Bioscience in 1988. The School consists of the Departments of Biotechnology and of Food Science and Technology.

Department of Biotechnology

Biotechnology employs a body of multidisciplinary expertise directed towards the utilization and recycling of natural resources by controlled biological action, usually in a reactor. Its study provides an appreciation of the capabilities of biological systems and the skills required to maximize these capabilities on the industrial scale. Particular attention is given to: the selection of the appropriate systems and their maximization by genetic and or enzyme tailoring; the design of biological reactors and their ancillary equipment; optimization and control of the processes. It is by these means that products are manufactured at ensured standards of quality. The products include certain foods and beverages, baker's yeast, antibiotics, steroids, vaccines, enzymes, amino acids, nucleotides, vitamins, organic acids, alcohols, metals, plant growth regulators and insecticides. Specific mammalian proteins, such as insulin and growth hormone, are also produced by microorganisms which have been genetically engineered to contain the appropriate mammalian gene.

Students proceeding to the BSc degree course through the Board of Studies in Science and Mathematics and who seek to undertake training in biotechnology may do so by combining such training with a major in another relevant discipline, preferably biochemistry, microbiology or chemistry.

The fourth Honours year includes further formal training as well as research in biotechnology. Alternatively, students with no previous training in biotechnology may undertake the biotechnology honours year, provided they have the necessary background training in biochemistry and microbiology; in such cases the Level III biotechnology units constitute the formal component.

Details of courses majoring in biotechnology are given in the Faculty of Science handbook.

Department of Food Science and Technology

Food Technology is the application of basic science to the management of foods from the time of production until their use by the consumer. It is concerned with optimum 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 demands an interdisciplinary and integrated approach, one that 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 and commerce.

The food technologist acquires new knowledge by laboratory and process research, and applies it to the development of acceptable foods 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.

There is a demand, both national and international, for professionally trained people who are prepared to accept responsibility for the quality and safety of humans' food supply, who can contribute to the solution of one of the greatest problems of our age, how to make food supplies grow faster than population.

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.

A Graduate Diploma course in Food Technology of one year fulltime or two years part-time is designed for graduates in science or agriculture wishing to familiarize themselves with the principles of food technology.

General Education Electives

For details of the General Education requirements see Faculty Information.

Staff

School of Applied Bioscience

Professor of Biotechnology, Head of School and Head of Department of Biotechnology
Peter Philip Gray, BSc *Syd.*, PhD *N.S.W.*, FIEAust, MAmerIChE, MABA

Professor of Food Technology
Vacant

Professor of Molecular Biology
*John Shine, BSc PhD A.N.U.

Professor of Applied Bioscience
Peter Lindsay Rogers, BE *Adel.*, DPhil *Oxf.*, MBA *N.S.W.*, DSc *Oxf.*

*Conjoint appointment with The Garvan Institute of Medical Research.

Department of Biotechnology

Head of Department of Biotechnology
Professor Peter Philip Gray

Professor
Peter Lindsay Rogers, BE *Adel.*, DPhil *Oxf.*, MBA *N.S.W.*, DSc *Oxf.*

Associate Professor
Noel William Dunn, MSc *Melb.*, PhD *Monash*

Senior Lecturers
Stephen Francis Delaney, BSc *Sheff.*, PhD *Liv.*
Robert James Hall, BSc PhD *N.S.W.*
John Colin Madgwick, MSc PhD *N.S.W.*

Lecturers
Pauline Mavis Doran, BE Qld., MSc PhD *CalTech.* MIChE
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Professional Officers
Russell George Cail, DipBiochem Bendigo I.T., PhD *N.S.W.*
John Alton Ide, BSc *PhD N.S.W.*
Mark Ronald Quinlan, BAppSc *N.S.W.I.T.*
Rose Ann Varga, BSc *N.S.W.*

Administrative Assistant
Robin Lee

Department of Food Science and Technology

Associate Professor and Acting Head of Department of Food Science and Technology
Kenneth Alan Buckle, BSc PhD N.S.W., FAIFST, FCIA

Associate Professors
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Senior Lecturer
Frances Maud Scriven, BSc PhD *N.S.W.*, AAIFST

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Robert Hilton Driscoll, BSc A.N.U., PhD *N.S.W.*, AAIFST

Principal Tutor
Jane Elizabeth Paton, BSc *N.S.W.*

Tutor
Jayashree Arcot, BSc MSc *Madras*, PhD *Hyd.*

Administrative Officer
Richard John Greenwood, BA *N.S.W.*

Professional Officers
Maxwell Robert Bell, BSc MAppSc N.S.W., ASTC
Yvone El-Ghetany, BScAg *Ains Shams*, MSc *N.S.W.*
Zbigniew Suminski, ME(Food Tech) *Olstzyn*

Honorary Visiting Fellow
Kevin Joseph Scott, BSc(Agr) Dip Ed Syd.

National Research Fellow
Vacant

Research Fellow
John David Craske, MSc PhD N.S.W., ASTC, FRACI, FTS, AAIFST

Food Industry Development Centre

Director
Vacant

Senior Research Officer
Frances Anne Warnock, BSc N.S.W., GDipEd *Adel.C.A.E.*, GDipND *Flin.*

Administrative Assistant
Joyce Weeks

Course Outlines

Undergraduate Study

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.

Year 1		**Hours per week** S1	S2
PHYS1002	Physics 1 *or*		
PHYS1022	Introductory Physics 1	6	6
CHEM1101	Chemistry 1A	6	0
CHEM1201	Chemistry 1B	0	6
MATH1032	Mathematics 1 *or*		
MATH1042	Higher Mathematics 1 *or*		
MATH1011	General Mathematics 1B *and*	6	6
MATH1021	General Mathematics 1C		
BIOS1011	Biology A	6	0
BIOS1021	Biology B	0	6
		24	24

Year 2			
CHEM2011	Physical Chemistry	0	6
CHEM2021	Organic Chemistry	5	1
CHEM2041	Chemical and Spectroscopic Analysis	0	6
MATH2819	Statistics SA	2	2
BIOC2312	Introductory Biochemistry	6	6
MICR2218	Microbiology	8	0
FOOD3210	Introductory Nutrition	3	0
FOOD4210	Introductory Food Engineering	0	3
		24	24

Year 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
BIOT3041	Principles of Biotechnology	3	0
CHEM3926	Analytical Instrumentation	0	3
	General Education Subject	0	4
		24	24

Year 4		**Hours per week** S1	S2
FOOD1400	Project	8	8
FOOD1410	Field Excursions	3	0
FOOD1420	Food Legislation	2	0
FOOD1430	Food Industry Management	2	0
	General Education Subjects	2	6
		17	14

Plus *three* or more of the following electives to a total of not less than 8.5 hours per week.

CHEM3021	Organic Chemistry	0	6
MANF0400	Production Management	3	3
MANF4610	Operations Research	3	3
MARK2012	Marketing Systems	4	0
MATK2052	Marketing Research	0	4
BIOT3051	Biotechnology Laboratory	0	3
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	0	6
FOOD4410	Advanced Food Engineering	3	0
FOOD4420	Food Packaging	3	0

or such other electives, to a total of not less than 8.5 hours per week, as approved by the Head of School.

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 School 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 day-time

classes, and substantial day-time release from industry may be required. Students who have completed the requirements of this course and have qualified for the award of the degree of Bachelor of Science (Technology) may proceed to the award of the degree of Bachelor of Science by attending for one full-time year and completing the subjects listed in Year 4 of the full-time course. Students desiring to proceed to the award of a BSc degree must apply to the Head of the School not later than 31 December of the year in which the sixth stage is completed.

Stages 1 and 2*		**Hours per week** S1	S2
PHYS1002	Physics 1 *or*		
PHYS1022	Introductory Physics 1	6	6
CHEM1101	Chemistry 1A	6	0
CHEM1201	Chemistry 1B	0	6
MATH1032	Mathematics I *or*		
MATH1042	Higher Mathematics 1' *or*	6	6
MATH1011	General Mathematics 1B *and*		
MATH1021	General Mathematics 1C		
BIOS1011	Biology A	6	0
BIOS1021	Biology B	0	6

*Physics and Mathematics are usually taken as Stage 1, the other subjects as Stage 2.
'There are no evening lectures in this subject.

Stage 3			
CHEM2021	Organic Chemistry	5	1
CHEM2041	Chemical and Spectroscopic Analysis	0	6
BIOC2312	Introductory Biochemistry	6	6
		11	13

Stage 4			
CHEM2011	Physical Chemistry	0	6
MATH2819	Statistics SA	2	2
MICR2218	Microbiology	8	0
FOOD3210	Introductory Nutrition	3	0
FOOD4210	Introductory Food Engineering	0	3
		13	11

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

Stage 6			
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
CHEM3926	Analytical Instrumentation	0	3
	General Education Subject	2	2
		13	13

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, Biochemical Engineering 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 before making a formal application for registration.

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 co-requisite.

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.

		Hours per week S1	S2
Obligatory Subjects			
BIOT3011	Biotechnology A	6	0
BIOT3021	Biotechnology B	0	6
BIOT5013	Practical Biotechnology	6	6
Elective Subjects			
BIOT3031	Microbial Genetics	6	0
BIOT8010	Graduate Seminars	2	2
BIOT7100	Biological Principles	3	0
BIOT7110	Bioengineering Principles	3	0
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:

		Hours per week S1	S2
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
BIOT7043	Biotechnology Project Major	8	8
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 material (generally designated as subjects without a suffixed G or X number) 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 degrees 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 School has developed special expertise.

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

Intending candidates are invited to contact the Head of the School for advice and recommendation. The basis of an acceptable program would be formal study aggregating at least 36 credits (1 credit equals 1 hour per week) for 2 sessions full-time or 18 credits for 4 sessions or 12 credits for 6 sessions part-time, and which 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 (generally designated as subjects without a suffixed G or X number) 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 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.

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:

Core components	**Credits***	
FOOD1527	Principles of Food Preservation	3
FOOD1557	Food Technology Laboratory	3
FOOD1707	Seminar 1	
FOOD1717	Major Research Project	9
OR		
FOOD1727	Research Project 6	
OR		
FOOD1737	Minor Project 3	

* These credits may be concentrated in one session.

Elective components
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 School.

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 co-requisites. A particular subject may not necessarily be conducted in any one year.

8031
Food Microbiology Graduate Course

Master of Applied Science
MAppSc

The MAppSc course in Food Microbiology is a formal course 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. It consists of lectures, laboratory sessions, seminars and a supervised project, and requires a program of subjects totalling 36 credits (1 credit equals 1 hour per week for one session). The degree will normally comprise one year of full-time study (two sessions of 18 credits) or two years of part-time study (four sessions of 9 credits each).

The course comprises:

Compulsory Subjects		Credits*
FOOD1707	Seminar	2
FOOD2517	Food Microbiology	4
FOOD2527	Microbiological Examination of Foods	6
FOOD2537	Microbiological Quality Control	1
FOOD2547	Food Microbiology Project	6

Elective Subjects		Credits*
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 subject to approval by the Head of School.

* These credits may be concentrated in one session.

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 emphasises 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:

Core components		Credits*
FOOD1707	Seminar	1
FOOD4527	Advanced Food Engineering	2
FOOD4557	Food Engineering Laboratory	1.5
FOOD1717	Major Research Project	9
OR		
FOOD1727	Research Project	6
OR		
FOOD1737	Minor Project	3

* These 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 School.

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 School.

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), or two years of part-time study (17 credits/year). It involves the following program:

Core components		Credits*
FOOD1527	Principles of Food Preservation	3
FOOD1537	Plant Food Products	1
FOOD1547	Animal Food Products	1.5
FOOD1557	Food Technology Laboratory	3
FOOD2517	Food Microbiology	2

* These 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 School. In all cases the hours devoted to graduate subjects constitute at least 50% of the total course hours.

Subject Descriptions

Undergraduate Study

Department of Food Science and Technology

FOOD1310 Food Preservation **S1 L3 T3**

Prerequisites: CHEM2011, CHEM2021, CHEM2041, BIOC2812, MICR2218, FOOD4210, FOOD3210.

Introduction to food preservation; spoilage control by traditional and modern techniques. Technology of food preservation by heat, 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. **(Old No. 49.131)**

FOOD1320 Plant Food Science **S1 L2**

Prerequisites: CHEM2011, CHEM2021, CHEM2041, BIOC2312, MICR2218, FOOD4210, FOOD3210.

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. **(Old No. 49.132)**

FOOD1330 Animal Food Science **S1 L3**

Prerequisites: CHEM2011, CHEM2021, CHEM2041, BIOC2312, MICR2218, FOOD3210.

Nature and distribution of world animal food resources. *Meat:* Muscle structure, function, slaughter, conversion of muscle to meat; chemical, biochemical factors in postmortem glycolysis; meat microbiology; chilling, freezing, curing, processing of meat and meat-derived products; processing equipment; meat marketing systems; nutritional and sensory properties of meats. *Milk and dairy products.* Chemical, physical properties, microbiology of milk; technology of milk-derived products including cheese, fermented products, butter; frozen, chilled and dried milk-derived foods. *Marine products.* Nature and distribution of world fishery resources; teleostean and elasmobranch species, spoilage mechanisms, quality assessment; preservation by chilling, freezing, salting, drying, smoking, marinading and fermentation; fish meal and fish protein concentrate. *Egg products.* Structure and composition of the avian egg; changes during storage of whole eggs; egg quality assessment; functional properties of egg components; preservation of the intact egg; pulping, freezing and drying of whole egg pulp, yolk and albumen. **(Old No. 49.133)**

FOOD1340 Quality Evaluation and Control **S2 L1 T1**

Prerequisites: MATH2819, FOOD1310, FOOD1320, FOOD1330, FOOD2310.

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. **(Old No. 49.134)**

FOOD1350 Food Technology Laboratory **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. **(Old No. 49.135)**

FOOD1400 Project **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. **(Old No. 49.140)**

FOOD1410 Field Excursions **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. **(Old No. 49.141)**

FOOD1420 Food Legislation **S1 L2**

Prerequisite: Completion of Year 3 subjects

An overview of Federal and State regulations affecting the production and marketing of foods; food imports and exports. Mechanisms for development of food standards. Principles of approval and usage of food additives. Codex standards. Implementation of food regulations. **(Old No. 49.142)**

FOOD1430 Food Industry Management **S1 L2**

Prerequisite: Completion of Year 3 subjects

An introduction to food industry management, accounting, finance, marketing, industrial relations and communication skills. **(Old No. 49.143)**

FOOD1440 Food Quality and Product Development **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. **(Old No. 49.144)**

FOOD1450 Food Processing Wastes **S2 L2 T1**

Prerequisite: FOOD1350

Effects of waste discharges into waterways. Treatment of water for domestic and industrial applications; water re-use; 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. **(Old No. 49.145)**

FOOD1460 Cereal Technology **S1 L2 T4**

Prerequisite: FOOD1350

A treatment in greater depth of the following topics dealt with in 49.132: production, storage, marketing and quality of cereal grains; current trends in these areas, technology of bread, biscuit and cake manufacture; chemical, physical and biochemical interactions in wheat flour doughs; flour milling and assessment of flour quality; cereal protein analysis, properties and behaviour; wheat variety identification; meat cereal combinations; cereal enzymes; non-food uses of cereals; preparation and uses of cereal protein, starches and lipids. **(Old No. 49.146)**

FOOD1470 Postharvest Technology of Foods **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. **(Old No. 49.147)**

FOOD2310 Food Microbiology **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. *Food-borne microbial disease;* foods as vectors of disease and food poisoning; statistics and epidemiology; ecology and taxonomy of food-borne pathogenic microorganisms; control and prevention by hygiene, microbiological standards and legislation. *Food fermentation:* microbial ecology and biochemistry of fermentations; fermentations of alcoholic beverages, bakery products, dairy products, meats, vegetables, cocoa beans, soy sauce; production of food ingredients and processing aids by fermentation. *Microbiological examination of foods:* sample preparation and sampling plans; sub-lethal injury; standard methods for determination of total plate counts, indicator organisms, food-borne pathogenic species, principal spoilage species. *Microbiological quality control:* specifications and standards; decision criteria; hazard analysis and critical control point (HACCP) concept. **(Old No. 49.231)**

FOOD2410 Advanced Food Microbiology **S2 L2 T4**

Prerequisite: FOOD2310

An advanced theoretical and practical treatment of the ecology, taxonomy, biochemistry and analytical technology of bacteria, yeasts, fungi and viruses associated with food spoilage, food-borne disease and food fermentations. Emphasis on: new developments in food microbiology; economic consequences of microorganisms in foods; exploitation of microorganisms in novel processes for the production of food ingredients and processing aids; new technologies for the detection of microorganisms in foods, including enzyme immunoassay, DNA-probes, bioluminescence, impedance, epifluorescent-filtration methods; practical problems associated with the microbiological analysis of foods and interpretation of data. **(Old No. 49.241)**

FOOD2420 Yeast Technology **S1 L2 T1**

Prerequisite: FOOD2310

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. **(Old No. 49.242)**

FOOD3210 Introductory Nutrition **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. **(Old No. 49.321)**

FOOD3310 Nutrition **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. **(Old No. 49.331)**

FOOD3410 Advanced Nutrition **S2 L3 T3**

Prerequisite: FOOD3310

Nutrition topics in relation to food and nutrition policy; the food industry and community nutrition in developing and industrialised countries; food enrichment, food allergies, supplementary feeding programs and nutrition education. Principles of the nutrient evaluation of foods. Practical sessions and computing using nutrient data bases. **(Old No. 49.341)**

FOOD4210 Introductory Food Engineering **S2 L2 T1**

Prerequisites: PHYS1002 or PHYS1022 and MATH1032 or MATH1011 or 10.021B and MATH1021.

Units and dimensions, dimensionless groups, dimensional analysis; material and energy balances; steady state and transient heat flow, insulation; heat exchangers; evaporation; distillation; psychrometry and dehydration; thermal properties of foods. **(Old No. 49.421)**

FOOD4310 Food Process Engineering **S2 L2 T2**

Prerequisite: FOOD4210

Food rheology, fluid flow and energy; refrigeration; mixing; filtration; extraction; grinding; pumps and pipes; extrusion; process measurement and control. **(Old No. 49.431)**

FOOD4320 Computer Applications **SS L1 T1**

Prerequisite: MATH2819.

Introduction to VAX/VMS, VM/CMS, MS-DOS and other control languages; the use of statistical, graphics and other program packages to solve problems in food science and technology. **(Old No. 49.432)**

FOOD4410 Advanced Food Engineering **S1 L2 T1**

Prerequisites: FOOD4310, FOOD4320.

Physical properties and measurement of food texture; numerical techniques, integrated food processing operations and process control; economics of process development; recent developments in food engineering. **(Old No. 49.441)**

FOOD4420 Food Packaging **S1 L2 T1**

Pre- or co-requisite: FOOD1310

Chemical and physical properties of packaging materials; interaction between package and food, selection of packaging materials and systems, evaluation of packaging materials and systems, package design criteria; laboratory work on physical properties of package materials and evaluation of packaging materials and systems. **(Old No. 49.442)**

Department of Biotechnology

Biotechnology is a Department within the School of Applied Bioscience.

BIOT3011 Biotechnology A **S1 L3 T3**

Prerequisites: BIOC2312 and MICR2218

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 fermenter operation, microbial enzyme isolation, visits to industrial fermentation plants and industrial seminars. **(Old No. 42.102A)**

BIOT3021 Biotechnology B **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. **(Old No. 42.102B)**

BIOT3031 Microbial Genetics **S1 L2 T4**

Prerequisites: BIOS2011, BIOS2021, BIOC2312 and MICR2011.
Excluded: MICR3021.

This unit is suitable for students majoring in Microbiology, Biochemistry, Biotechnology or Genetics. It deals with major aspects of the genetics of bacteriophage, bacteria and yeast. Topics include plasmids and transposible genetic elements, gene transfer, mutagenesis and DNA repair, mutants, bacteriophage genetics, gene cloning (vectors, recombinant DNA techniques) and genetics of nitrogen fixation. **(Old No. 42.102C)**

BIOT3041 Principles of Biotechnology **S1 L3**

Prerequisite: BIOC2312 and MICR2218

Lecture component of BIOT3011 Biotechnology A. **(Old No. 42.102D)**

BIOT3051 Biotechnology Laboratory **S1 T3**

Prerequisite: BIOT3041.

Laboratory component of BIOT3011 Biotechnology A. **(Old No. 42.102E)**

BIOT3061 Modern Techniques in Biotechnology S2 L2 T4

Prerequisites: 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. **(Old No. 42.102H)**

BIOT3100 Fermentation Processes **S2 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. **(Old No. 42.114)**

BIOT4073/BIOT4083 Biotechnology Honours

Advanced formal training in selected areas of biotechnology and participation in one of the school's research projects. **(Old No. 42.103)**

BIOT4093 Biological Process Engineering **F L2 T4**

Prerequisite: MICR2201.

Structure of Metabolism: Growth of an undifferentiated organism as a physico-chemical 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. Macro-molecule production. Coordination and control of cellular processes. *Industrial Bio-processes:* A review of bio-process industries. The selection, screening and maintenance of commercial cultures. The optimization of bio-processes. 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. **(Old No. 42.105)**

Graduate Study

Department of Food Science and Technology

Food Science and Technology is a Department within the School of Applied Bioscience.

FOOD1507 Introductory Food Science **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. **(Old No. 49.150G)**

FOOD1517 Chemistry, Biochemistry and Physics of Foods **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. **(Old No. 49.151G)**

FOOD1527 Principles of Food Preservation **S1 L3 T3**

Spoilage control by traditional and modern techniques. Technology of food preservation by heat, 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. **(Old No. 49.152G)**

FOOD1537 Plant Food Products **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. **(Old No. 49.153G)**

FOOD1547 Animal Food Products **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 cheeze, fermented products, butter, frozen, chilled and dried milk-derived foods. *Marine products:* nature and distribution of world fishery resources; teleostean and elasmobranch species, spoilage mechanisms, quality assessment; preservation by chilling, freezing, salting, drying, smoking, marinading and fermentation; fish meal and fish protein concentrate. *Egg products:* structure and composition of the avian egg; changes during storage of whole eggs; egg quality assessment; functional properties of egg components; preservation of the intact egg; pulping, freezing and drying of whole egg pulp, yolk and albumen. **(Old No. 49.154G)**

FOOD1557 Food Technology Laboratory **S2 T6**

Prerequisites: 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. **(Old No. 49.155G)**

FOOD1607 Dairy Technology **S2 L1 T1**

Prerequisite: FOOD1547 or equivalent

A detailed review of trends in dairy industries at the national and international levels. The microbiology and biochemistry of dairy products with particular reference to the technology of milk, butter and cheese production. The development of new dairy products, the use of dairy products in other foods. Emphasis is placed upon the use and development of new technologies in the broad areas of dairy product processing. **(Old No. 49.160G)**

FOOD1617 Oenology **S1 L2**

History of wine production, statistics and classification. Viticulture. Grape composition. Technology and biochemistry of production of table wines, sparkling wines, vermouths, sherries; quality control procedures. Legal, cultural, climatic factors in French, Spanish, Portuguese, Italian, German, Californian and Australian wine production. Principles of sensory testing and evaluation of wines. **(Old No. 49.161G)**

FOOD1627 Technology of Cereal Products **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 bleaches 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. **(Old No. 49.162G)**

FOOD1637 Marine Products **S2 L2**

Prerequisite: FOOD1547 or equivalent

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. **(Old No. 49.163G)**

FOOD1647 Food Additives and Toxicology **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. **(Old No. 49.164G)**

FOOD1657 Postharvest Physiology and Handling of Fruit and Vegetables **S1 L1 T5**

Pre or co-requisite: 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. **(Old No. 49.165G)**

FOOD1667 Postharvest Storage of Foods **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. **(Old No. 49.166G)**

FOOD1701 Seminar **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. **(Old No. 49.170G)**

FOOD1717 Major Research Project **F T9**

A detailed investigation of a selected topic in food science and technology including submission of a project report. **(Old No. 49.171G)**

FOOD1727 Research Project **F T6**

An investigation of an aspect of food science and technology and submission of a project report. **(Old No. 49.172G)**

FOOD1737 Minor Project **F T3**

A study of an aspect of food science and technology and submission of a project report. **(Old No. 49.173G)**

FOOD1747 Special Topics in Food Science and Technology **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. **(Old No. 49.174G)**

FOOD1757 Special Topics in Food Science and Technology **S1 or S2 T3**

A similar but shorter investigation to that outlined in FOOD1747. **(Old No. 49.175G)**

FOOD1767 Reading Assignment **SS T1**

A reading assignment in an area supporting candidates' major disciplines or commodity interests. Presentation of a seminar may be required. **(Old No. 49.176G)**

FOOD2507 Introductory Food Microbiology **S1 L2T2**

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. **(Old No. 49.250G)**

FOOD2517 Food Microbiology **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. *Food-borne microbial disease:* foods as vectors of disease and food poisoning; statistics and epidemiology; ecology and taxonomy of food-borne pathogenic microorganisms; control and prevention by hygiene, microbiological standards and legislation. *Food fermentation:* microbial ecology and biochemistry of fermentations; fermentation of alcoholic beverages, bakery products, dairy products, meats, vegetables, cocoa beans, soy sauce; production of food ingredients and processing aids by fermentation. *Microbiological examination of foods:* sample preparation and sampling plans; sub-lethal injury; standard methods for determination of total plate counts, indicator organisms, foodborne pathogenic species, principal spoilage species. *Microbiological quality control:* specifications and standards; decision criteria; hazard analysis and critical control point HACCP concept. **(Old No. 49.251G)**

FOOD2527 Microbiological Examination of Foods **S2 L2 T4**

Prerequisite: FOOD2517 or equivalent

Detailed lecture and laboratory consideration of standard methods and new methods and technologies for the microbiological analysis of foods. Rapid cultural methods; immunoassay, DNA-probe, impedance, bioluminescence,

image analysis-epifluorescence (DEFT), Petrifilm, computer identification of microorganisms. Measurement of 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. **(Old No. 49.252G)**

FOOD2537 Microbiological Quality Control **S2 L1**

Prerequisite: FOOD2507 or equivalent
Co-requisite: FOOD2527

A theoretical and practical consideration of: food hygiene; cleaning and sanitation programs; HACCP; microbiological specifications and standards; food legislation; food inspection; setting up and management of a laboratory for the microbiological analysis of foods.

FOOD2547 Food Microbiology Project **FT3**

Prerequisite: FOOD2517

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

FOOD2557 Microbial Spoilage of Foods **S2 L1**

Prerequisite: FOOD2517

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

FOOD2567 Foodborne Microorganisms of Public Health Significance **S2L2**

Prerequisite: FOOD2517
Co-requisite: 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 **S2L2**

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 **S2L1**

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 shelf-life, as agents to improve the nutritive and therapeutic value of foods, immobilized cell and cell reactor technologies for conducting food and beverage bioconversions.

FOOD3507 Introductory Nutrition **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. **(Old No. 49.350G)**

FOOD3517 Nutrition **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. **(Old No. 49.351G)**

FOOD3527 Advanced Nutrition **S2 L3 T3**

Prerequisite: FOOD3517 or equivalent

Nutrition topics in relation to food and nutrition policy; the food industry and community nutrition in developing and industrialised countries; food enrichment, food allergies, supplementary feeding programs and nutrition education. Principles of the nutrient evaluation of foods. Practical sessions and computing using nutrient data bases. **(Old No. 49.352G)**

FOOD4507 Food Engineering Principles **S2 L2 T1**

Prerequisites: First year mathematics and physics or equivalents

Units and dimensions, dimensionless groups, dimensional analysis; material and energy balances; steady state and transient heat flow, insulation, heat exchangers, freezing; evaporation; distillation; psychrometry and dehydration; thermal properties of foods. **(Old No. 49.450G)**

FOOD4517 Unit Operations in Food Engineering **S2 L2 T2**

Prerequisite: FOOD4507 or equivalent

Food rheology, fluid flow and energy; refrigeration; mixing; filtration; extraction; grinding; pumps and pipes; extrusion; process measurement and control. **(Old No. 49.451G)**

FOOD4527 Advanced Food Engineering **S2 L2 T2**

Prerequisites: FOOD4517, FOOD4537 or their equivalent

Mathematical representation of heat and mass transfer and fluid mechanics in food processing. Numerical techniques and computer modelling; design of integrated food processing operations and process control; economics of

process development and control; recent advances in food engineering. **(Old No. 49.452G)**

FOOD4537 Computing in Food Science **S2 L1 T1**

Prerequisite: An introductory statistics subject or equivalent

Introduction to VAX/VMS, VM/CMS, MS-DOS and other control languages; the use of statistical, graphics and other program packages to solve problems in food science and technology. **(Old No. 49.453G)**

FOOD4547 Technology of Food Drying **S2 L2 T1**

Psychrometry. Derivation and application of psychrometric equations for air-water systems. Principles of drying. Calculation of mass and energy balances around drying equipment. Calculation of drying time. Commercial drying equipment. Principles of liquid food evaporation. Diffusion of gases. Assessment of package performance. Prediction of shelf life. **(Old No. 49.454G)**

FOOD4557 Food Engineering Laboratory **S2 T3**

Co-requisite: FOOD4527

Laboratory and pilot plant exercises illustrating the principles and procedures involved in food processing and food quality assessment. **(Old No. 49.455G)**

FOOD4567 Food Engineering Field Work **S1 T3**

Inspection of food processing factories, agricultural and food research establishments and food producing areas. **(Old No. 49.456G)**

FOOD4577 Principles of Food Packaging **S1 or S2 L2 T1**

Co-requisite: FOOD1527

History of food packaging; chemical and physical properties of package materials; interaction between food and package; evaluation of packaging materials and systems; selection of packaging materials and systems; design criteria; laboratory work on physical properties of package materials and on evaluation of packaging materials and systems. **(Old No. 49.457G)**

Department of Biotechnology

Biotechnology is a Department within the School of Applied Bioscience.

General

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

BIOT8010 Graduate Seminars **F T2 (Old No. 42.104G)**

BIOT7010 Reading List in Biotechnology (Microbiology) **S1 or S2 T3 (Old No. 42.111G)**

BIOT7020 Reading List in Biotechnology (Biochemistry) **S1 or S2 T3 (Old No. 42.112G)**

BIOT7030 Biotechnology **SS L2 T1**

The selection, maintenance and genetics of industrial organisms; metabolic control of microbial synthesis; fermentation kinetics and models of growth; batch and continuous culture; problems of scale-up and fermenter design; control of the microbial environment; computer/fermentor interactions. Industrial examples will be selected from: antibiotic and enzyme production, alcoholic beverages, single cell protein (SCP), microbial waste disposal and bacterial leaching. *Tutorial practical sessions* include: problem solving, instrumentation, continuous culture techniques, and mathematical modelling and simulation of industrial processes. **(Old No. 42.214G)**

BIOT5013 Practical Biotechnology **F T6**

Illustration, demonstration and operation of laboratory-scale and pilot-scale equipment. Visits to appropriate industries. Experimental project or critical review. **(Old No. 42.215G)**

BIOT7043 Biotechnology Project (Major) **F T8**

An experimental or technical investigation or design project in the general field of biotechnology. **(Old No. 42.306G)**

BIOT7051 Applied Genetics **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 rec-DNA techniques. Properties of expression, excretion and genetic stability of constructs. **(Old No. 42.401G)**

BIOT7061 Peptide and Protein Technology **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 down-stream 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. **(Old No. 42.402G)**

BIOT7071 Biochemical Engineering **S2 L2 T3**

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

Detailed examples of bioprocesses including: amino acid production, single cell protein and liquid fuels; secondary metabolite production, growth and product formation of animal and plant tissue cultures. Patent and commercial aspects of bioprocesses. **(Old No. 42.403G)**

BIOT7081 Environmental Biotechnology **S1 L2 T3**

Environmental Biotechnology examines the way microbes decompose chemically complex materials. Applications include the use of bacteria and fungi to detoxify wastes, converting them to usable substances. Prevention of biodeterioration of valuable materials is also an important area of study. Lectures cover biodegradation of minerals, metals, cellulosics, aromatics, hydrocarbons and waste-water treatment. Students present research reviews and conduct experimental projects. **(Old No's. 42.404G and 42.405G)**

BIOT7091 Applied Cellular Physiology **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. **(Old No. 42.406G)**

BIOT7100 Biological Principles **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. Microorganisms of commercial significance. Biodeterioration and biodegradation. Pathogenic microorganisms: aetiology and epidemiology of infection; host defence mechanisms; chemotherapy; mechanisms of drug action; drug resistance. **(Old No. 42.407G)**

BIOT7110 Bioengineering Principles **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.

Lamina 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 descriptive only.

Quantification of complex systems. Empirical and mechanistic models in biological systems. **(Old No. 42.408G)**

BIOT7123 Biotechnology Project Minor **F T4**

A small experimental or design project, or an extensive literature review and analysis of a selected topic in biotechnology. **(Old No. 42.502G)**

School of Chemical Engineering and Industrial Chemistry

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 and the Centre for Petroleum Engineering which service three degree courses, and the Departments of Fuel Technology and Polymer Science 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.

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.

For the award of Honours in the Chemical Engineering, Industrial Chemistry and Petroleum Engineering 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 and Petroleum Engineering must obtain a minimum of twelve weeks' professionally oriented or industrial experience.

It is compulsory that, before graduation, students in the fulltime 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.

Staff

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Ross James Smith, BSc PhD N.S.W.

Department of Chemical Engineering

Head
Professor M. S. Wainwright

Department of Fuel Technology

Head
Associate Professor G. D. Sergeant

Department of Industrial Chemistry

Head
Associate Professor Michael Paul Brungs

Department of Polymer Science and Technology

Head
Associate Professor R. P. Burford

Centre for Petroleum Engineering Studies

Director
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Ms Lynn Causer

Centre for Membrane and Separation Technology

Director
Professor C.J.D. Fell

Director, Chemical Engineering
Professor A. G. Fane

Centre for Particle and Catalyst Technologies

Director
Professor M. S. Wainwright

Course Outlines

Undergraduate Study

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. Evening classes are only available in most Year I subjects.

Year 1 (New Course)		**Hours per week** S1	S2
PHYS1002	Physics 1	6	6
CHEM1101	Chemistry 1A *and*	6	0
CHEM1201	Chemistry 1B *or*	0	6
CHEM1002	Chemistry 1M	6	6
CHEN1010	Introduction to Chemical Engineering	2	2
MECH1300	Engineering Mechanics 1	0	4
MECH0130	Engineering Drawing and Descriptive Geometry	4	0
MATH1032	Mathematics 1	6	6
	General Education Subject	2	2
		26	26

Year 2 (New Course)			
CHEM2011	Physical Chemistry	6	0
CHEM2828	Organic and Inorganic Chemistry (for Chemical Engineers)	4	0
CEIC2010	Instrumental Analysis	3	3
CEIC2020	Computing	1	2
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	1	2
ELEC0802	Electrical Power Engineering	0	3
MATH2021	Mathematics	2	2
MATH2819	Statistics SA	2	2
	General Education Subject	2	2
		25	25

Year 3 (New Course)		**Hours per week** S1	S2
CHEN3010	Engineering Thermodynamics	4	0
CEIC3010	Reaction Engineering	0	3
CHEN3020	Numerical Methods	0	3
CHEN3070	Process Control	0	2
CHEN3030	Fluids II	2	0
CHEN3040	Separation Processes 1	2	2
CHEN3050	Particle Mechanics	3	0
CHEN3060	Process Plant Engineering I	4	4
CHEN3080	Chemical Engineering Laboratory II	1.5	1.5
CHEN3090	Chemical Engineering Applications*	4	4
CIVL0616	Structures	3	0
MATH3021	Mathematics	2	2
	General Education subject	2	2
		25.5	25.5

(*Students taking the Fuel and Energy Engineering or Minerals Engineeing Electives follow a modified program described below under "Professional Electives in Course 3040").

Year 4 (New Course)			
CHEN4090	Research Project*	4	8
CHEN4070	Process Dynamics and Control	3	2
CHEN4020	Advanced Reaction Engineering*	2	0
CHEN4010	Separation Processes 11	2	0
CHEN4060	Process Plant Engineering II	4	0
CHEN4030	Safety and Environmental*	2	0
CHEN4050	Process Plant Operation*	0	3
CHEN4040	Management	2	2
CHEN4080	Design Project	1	4
CHEN4100	Professional Electives*	3	3
		23	22

(*Students taking the Fuel and Energy Engineering or Minerals Engineering Electives follow a modified Program described below under "Professional Electives in Course 3040").

Professional Electives in Course 3040 Chemical Engineering

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 fossil fuels 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.

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, non-ferrous, 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.

Year 3:		**S1**	**S2**
MINE0130	Principles of Mining	0	2
GEOL5410	Mineralogy for Mineral Engineering	2	0
MINE3101	Mineral Process Engineering	2	2
Year 4:			
MINE4101	Mineral Processing Practices	2	0
MINE4201	Pyrometallurgical Processes	2	0
MINE4301	Hydrometallurgical Processes	2	0
MINE4302	Hydrometallurgy Practices	3	0
MINE4303	Hydrometallurgical Process Engineering	0	2
MINE4401	Mine Waste Disposal & the Environment	0	2
MINE4402	Mineral Engineering Project	4	8

3100
Industrial Chemistry - Full-time Course

Bachelor of Science
BSc

Year 1		**Hours per week** S1	S2
PHYS1002	Physics 1	6	6
CHEM1102	Chemistry 1A and	6	0
CHEM1201	Chemistry 1B	0	6
or			
CHEM1002	Chemistry 1M	6	6
MATH1032	Mathematics 1	6	6
INDC1010	Industrial Chemistry 1	2	2
MECH0330	Engineering Mechanics	0	4
and			
MECH0130	Engineering Drawing and Descriptive Geometry	4	0
		24	24

Year 2		**Hours per week** S1	S2
PHYS2920	Electronics	3	0
CHEM2011	Physical Chemistry	6	0
CHEM2031	Inorganic Chemistry	0	6
CHEM2021	Organic Chemistry	2	4
MATH2021	Mathematics	2	2
MATH2819	Statistics SA	2	2
CEIC2010	Instrumental Analysis	3	3
INDC2020	Introduction to Fluid Flow	2	1
INDC2010	Mass and Energy Balances	2	0
INDC2030	Heat Transfer and Temperature Measurement	0	2
CEIC2020	Computing	1.5	1.5
	General Education Subject	0	2
		23.5	23.5

Year 3		S1	S2
CHEM3829	Organic Chemistry	6	0
CEIC3010	Reaction Engineering	1	2
INDC3090	Chemistry of Industrial Processes	3	3
INDC3040	Corrosion in the Chemical Industry	0	2
POLY3010	Thermodynamics	3	0
INDC3060	Industrial Chemistry 2A	2	0
INDC3020	Industrial Chemistry 2B	0	3
INDC3030	Experimental Design	0	2
INDC3070	Instrumentation and Process Control 1	1	2
INDC3050	Chemistry of High Temperature Materials	0	2
INDC3080	Instrumental Analysis 2	4	0
POLY3010	Polymer Science	3	3
	General Education Subject	2	2
		25	21

Year 4

		Hours per week S1	S2
CEIC4010	Process Economics 1	1	0
CEIC4020	Process Economics 2	0	1
BIOT3100	Fermentation Processes	0	2
INDC4040	Management	0	2
INDC4020	Applied Kinetics	2	0
INDC4010	Applied Thermodynamics	2	0
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	2	2
		26	25

3110
Industrial Chemistry - Part-time Course

Bachelor of Science (Technology)
BSc (Tech)

Stages 1 and 2*

		Hours per week S1	S2
PHYS1002	Physics 1	6	6
CHEM1101	Chemistry 1A and	6	0
CHEM1201	Chemistry 1B	0	6
INDC1010	Industrial Chemistry 1	2	2
MATH1032	Mathematics 1	6	6
MECH0330	Engineering Mechanics	0	4
and			
MECH0130	Engineering Drawing and Descriptive Geometry	4	0
		24	24

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

Stage 3

CHEM2011	Physical Chemistry	6	0
MATH2021	Mathematics	2	2
MATH2819	Statistics SA	2	2
CEIC2010	Instrumental Analysis	3	3
	General Education Subject	2	2
		15	9

Stage 4

PHYS2920	Electronics	3	0
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
CEIC2020	Computing	1.5	1.5
		14.5	9.5

Stage 5

		Hours per week S1	S2
INDC3040	Corrosion in the Chemical Industry	0	2
INDC3010	Thermodynamics	3	0
CEIC3010	Reaction Engineering	1	2
INDC3060	Industrial Chemistry 2A	2	0
INDC3020	Industrial Chemistry 2B	0	3
INDC3030	Experimental Design	0	2
INDC3050	Chemistry of High Temperature Materials	0	2
INDC3080	Instrumental Analysis 2	4	0
	General Education Subject	2	2
		12	13

Stage 6

CHEM3829	Organic Chemistry	6	0
INDC3090	Chemistry of Industrial Processes	3	3
INDC3070	Instrumentation and Process Control 1	0	3
POLY3010	Polymer Science	3	3
		12	9

Centre for Petroleum Engineering Studies

The Centre of Petroleum Engineering 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 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.

3045
Petroleum Engineering - Full-time Course

Bachelor of Engineering
BE

Year 3		Hours per week S1	S2
CIVL0616	Structures	3	0
MATH3021	Mathematics	2	2
PTRL3001	Reservoir Rock Properties and Fluid Flow in Porous Media	2	0
PTRL3006	Drilling Fluids and Cementing	0	3
PTRL3007	Reservoir Engineering 1	0	2
PTRL3002	Rock and Fluid Properties Laboratory	3	0
PTRL3008	Petroleum Production Economics	0	1
PTRL3003	Petroleum Thermodynamics	2	0
PTRL3105	Formation Evaluation 1	2	2
PTRL3009	Fundamentals of Drilling Engineering	2	0
GEOL5300	Physical Geology for Petroleum Engineers 1	3	0
GEOL5320	Physical Geology for Petroleum Engineers 2	0	3
GEOL5370	Structural Geology	0	3
CHEN3040	Separation Processes	2	2
CHEN3070	Process Control	1	1
	General Education Subject	2	2
		24	21

Year 4			
PTRL4007	Reservoir Engineering 2	0	3
PTRL4105	Well Completion and Production Operations	0	3
PTRL4105	Formation Evaluation 2	2	2
PTRL4008	Oil and Gas Law and Regulation	0	2
PTRL4001	Reservoir Simulation	0	3
PTRL4002	Advanced Recovery Methods	0	3
PTRL4109	Petroleum Engineering Project	8	4
PTRL4003	Well Pressure Testing	2	0
PTRL4004	Advanced Drilling Engineering	3	0
PTRL4010	Drilling and Production Laboratory	3	0
CHEN3060	Process Plant Engineering 1 (Modified for Petroleum Engineers)	4	4
CHEN4070	Process Dynamics and Control	3	2
CHEN4030	Safety and Environmental	2	0
		27	26

Graduate Study

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
and	
Petroleum Engineering	Course being arranged

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.

Centre for Petroleum Engineering

The Centre offers courses that cover the areas of Reservoir Engineering, Production Engineering and Formation Evaluation. Suggested course outlines are available from the Director of the Centre.

5031
Petroleum Engineering Graduate Diploma Course

Graduate Diploma in Engineering (Petroleum) GradDip

The oil industry traditionally employs 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. At the end of the formal course, satisfactory completion of a two-months practical assignment in the oil industry will be required, for the diploma to be awarded.

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 Centre for Petroleum Engineering.

The one year (two session) program course consists of the following subjects:

Session 1		**Hours Per Week**
PTRL5001	Reservoir Rock Properties	2
PTRL5006	Well Drilling and Completions	3
PTRL5002	Drilling and Production Lab.	3
PTRL5011	Production Engineering	3
PTRL5003	Well Pressure Testing	2
PTRL5105	Formation Evaluation	2
GEOL5300	Physical Geology for Petroleum Engineering I	3
		18

Session 2		**Hours Per Week**
PTRL5011	Properties and Phase Behaviour	2
PTRL5008	Petroleum Production Economics	1
PTRL5007	Reservoir Engineering	2
PTRL5004	Reservoir Simulation Fundamentals	3
PTRL5109	Petroleum Engineering Project	6
PTRL5105	Formation Evaluation	2
GEOL5320	Physical Geology for Petroleum Engineering II	3
PTRL5010	Practical Assignment*	
		19

*Two months practical assignment taken at end of formal course.

Subject Descriptions

Undergraduate Study

Centre for Petroleum Engineering

PTRL3001 Fundamentals of Fluid Flow in Porous Media **S1 L2**

Steady state single phase flow in porous media. Darcy's law for linear and radial systems. Flow in series and parallel. Radial diffusivity equation. Ei-function solution. Principle of superposition. **(Old No. 20.302)**

PTRL3002 Rock and Fluid Properties Laboratory **S1 L3**

Prerequisite: PTRL3001. Co-requisite: PTRL3006.

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. **(Old No. 20.305)**

PTRL3003 Petroleum Thermodynamics **S1 L2 T1**

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. **(Old No. 20.307)**

PTRL3006 Drilling Fluids and Cementing **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. **(Old No. 20.303)**

PTRL3007 Reservoir Engineering I **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. **(Old No. 20.304)**

PTRL3008 Petroleum Production Economics **S1 L1**

Basic elements of profitability analysis. Depreciation, financial statements, interest, time value of money. The financial plant, outside share, planning and scheduling, pricing and costs. Profitability. Criteria, applications of present value profiles, risk and risk adjustment. **(Old No. 20.306)**

PTRL3105 Formation Evaluation 1 **F L2**

Formation evaluation concepts. Data integration. Basic parameters and relationships. Environmental corrections. Log quality control. General Purpose well logs. Fluid and formation resistivities. Porosity, lithology and permeability studies with logs. Shaly sand log interpretation. Well site and computer processed analysis. Case study in an Australian oil field. **(Old No. 20.308)**

PTRL3009 Fundamentals of Drilling Engineering **S1 L2**

Rotary drilling rig components. Drilling fluid circulating system. Bottom-hole assemblies, well control and blowout prevention equipment and methods. Special marine equipment and drilling cost analysis.

PTRL4001 Reservoir Simulation Fundamentals **S2 L3**

Prerequisites: PTRL4007, 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. **(Old No. 20.406)**

PTRL4002 Advanced Recovery Methods **S2 L3**

Prerequisites: PTRL4007.

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 surfactant, alcohol, hydrocarbon-miscible, and carbon dioxide flooding processes. Compositional numerical reservoir simulators. Field applications of EOR technologies. **(Old No. 20.407)**

PTRL4003 Well Pressure Testing **S1 L2**

Theory of transient well testing. Practical aspects of design and performance of field tests. Analysis of transients pressure data, effects of boundaries, reservoir hetrogeniety, multiphase flow. Study of production, DST and formation interval tests. Pulse testing and multi-well tests. Computer assisted well test analysis techniques. **(Old No. 20.410)**

PTRL4004 Advanced Drilling Engineering **S1 L3**

Drilling methods and elements of rock mechanics. Rotary drill bits. Prediction of formation pore pressure and fracture gradient. Casing design. Directional drilling and deviation control. Coring practices. Fishing operations.

PTRL4006 Well Completion and Production Operations **S2 L3**

Prerequisite: PTRL3007

Reservoir considerations in well completion. Well completion designs. Basic types, function and operation of subsurface equipment. Perforating. Sand control. Hydraulic fracturing and acid treatment. Control of formation damage. Artificial lift methods. Gathering, separation and distribution of oil and natural gas. **(Old No. 20.403)**

PTRL4007 Reservoir Engineering 2 **S2 L3**

Prerequisite: PTRL3007

Waterflooding, prediction of water influx. P_{tD} and Q_{tD} solutions. Prediction of reservoir performance with water influx. Reservoir wettability and its effect on reservoir performance. **(Old No. 20.401)**

PTRL4008 Oil and Gas Law and Regulation **S1 L2**

Introduction to government legislation and control. Jurisdiction over onshore and offshore petroleum resources. The basic title system. Allocation of permits and licences. Expenditure commitments. Rental and royalty payments. Pipeline licences. Discretionary government controls, Aboriginal land rights. Environmental acts and regulations. **(Old No. 20.405)**

PTRL4010 Drilling and Production Laboratory **S1 L3**

The program includes measurement and control of the basic properties of drilling fluid (density, viscosity, filtration, lubricity and electro-chemical porperties) and cement slurry (density, viscosity, filtration, thickening time and mechanical properties). The program also includes a workshop on log interpretation.

PTRL4020 Natural Gas Engineering **S2 L3**

Basic gas reservoir engineering. Study of the composition and properties of natural gas, production methods, estimation of gas reserves, recovery of liquifiable products from gas, conditioning, transmission, compression and measurement of natural gas. Gas well testing including flow-after-flow, isochronal testing, transient testing, deliverability forecasting. Subject to be offered from time to time. **(Old No. 20.408)**

PTRL4105 Formation Evaluation 2 **F L2**

Prerequisite: PTRL3105

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. **(Old No. 20.404)**

PTRL4109 Petroleum Engineering Project **S14 S2 L11**

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. **(Old No. 20.409)**

Chemical Engineering and Industrial Chemistry

General

Students are expected to possess a calculator having exponential capabilities (ln x and exp x or 'x to the y'), and this will normally be allowed to be used in examinations. However, it should be noted that calculators with very much greater capabilities than the above might not be allowed in examinations, because they could give the user an unfair advantage over other candidates. 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.

CEIC2010 Instrumental Analysis **F L1 T2**

Prerequisites: PHYS1002, CHEM1101, CHEM1201.

Data treatment, error analysis and propagation of errors. Basic principles of volumetric analysis. Solubility and pH calculations. Electronic analysis ! potentiometric, voltametric and coulometric. Spectrophotometric analysis ! UV/visible, atomic emission, atomic absorbtion, X ray diffraction and fluoresence. Chromatographic analysis ! gas chromatography, high performance liquid chromatography, and ion chromatography. **(Old No. 3.021)**

CEIC2020 Computing **F L1 T.5**

Prerequisite: MATH1032

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. **(Old No. 3.022)**

CEIC4010 Process Economics 1 **S1 L1**

Consists of the segment Process Economics form CHEN3060 Process Plant Engineering 1

CEIC4020 Process Plant Economics 2 **S2 L1**

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

CEIC3010 Reaction Engineering **S1 L1 S2 L1 T1**

Prerequisites: CHEM2011, CEIC2020, 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 non-adiabatic operation, product distribution and temperature. *Kinetics of rate processes:* Significance of the rate laws and models for distributed and lumped parameter systems. Experimental measurement and correlation of process rates. **(Old No. 3.032)**

CEIC4200 Industrial Experience

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. **(Old No. 48.090)**

CEIC4210 Industrial Experience

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 **F L1 T1**

Introduction to the processing industry and chemical engineering practice. The role and responsibilities of the chemical engineer. Introduction to materials of construction for the processing industries. Application of process calculations in chemical process operations. Conventions in methods of analysis and measurement. The chemical equation and stoichoimetry. Introduction to material balancing. Process calculations associated with gases, vapours and liquids. **(Old No. 3.110)**

CHEN2010 Material and Energy Balances **F L1 T1**

Prerequisites: CHEM1101, CHEM1201, CHEN1010, MECH1300, MATH1032

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 integro/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. **(Old No. 3.121)**

CHEN2020 Flow of Fluids **F L1 T1**

Prerequisites: PHYS1002, CHEN1010, MECH1300, 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. **(Old No. 3.122)**

CHEN2030 Heat Transfer **S2 L2 T1**

Prerequisites: PHYS1002, CHEN1010, MECH1300, 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. **(Old No. 3.123)**

CHEN2040 Mass Transfer Fundamentals **S2 L1 T1**

Prerequisites: PHYS1002, CHEM1101, CHEM1201, CHEN1010, 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.

CHEN2050 Chemical Engineering Laboratory I **F T1**

Prerequisites: PHYS1002, CHEM1101, CHEM1201, CHEM1002, CHEN1010, MECH1300, MECH0130, MATH1032.

An introduction to laboratory work in chemical engineering including information retrieval techniques. **(Old No. 3.124)**

CHEN3010 Engineering Thermodynamics **S1 L2 T1 S2 L1**

Co or Prerequisites: CHEM2011, 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. **(Old No. 3.031)**

CHEN3020 Numerical Methods **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. **(Old No. 3.033)**

CHEN3030 Fluids 2 **F L1**

Prerequisites: CEIC2020, CHEN2020, MATH2021.

Single and Two-phase flow. Derivation of Navier Strokes Equation and solutions for inviscid flow, boundary layer flow, non-Newtonian flow. **(Old No. 3.131)**

CHEN3040 Separation Processes **F L1 T1**

Prerequisites: CHEM2011, CHEN2010, CHEN2020, CHEN2030, CHEN2040, CHEN2050.

Stagewise Processes: Phase equilibrium. Absorption. Binary distillation. Liquid-liquid extraction. *Design of Mass Transfer Equipment:* Equipment design for absorption, distillation, liquid-liquid extraction and adsorption processes. Unit design for stagewise and differential contact. Design of equipment for membrane and other surface separation processes. *Simultaneous Heat and Mass Transfer:* Psychrometry. Cooling Towers. Drying. **(Old No. 3.132)**

CHEN3050 Particle Mechanics **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. **(Old No. 3.133)**

CHEN3060 Process Plant Engineering 1 **F L3 T1**

Prerequisites: CHEN2010, CHEN2020, CHEN2030, ELEC0802, MATH2021.

Processing Engineering I: All activities required from the conception of the idea to produce a product through to the finalisation of the process flow diagram including process selection and evaluation, process design, process simulation, process representation, process acquisition and licensing. *Project Engineering I:* Outline of scope of a process plant including plant location and layout, processing facilities and 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. **(Old No. 3.134)**

CHEN3070 Process Control **F L1**

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. **(Old No. 3.034)**

CHEN3080 Chemical Engineering Laboratory 2 **F T1.5**

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. **(Old No. 3.135)**

CHEN3090 Chemical Engineering Applications **F L2 T2**

Prerequisites: CHEM2011, CEIC2020, CHEN2010, CHEN2020, CHEN2030, MATH2021, MATH2819.

Application of chemical engineering principles to biochemical engineering, fuel engineering, solids handling, alumina and aluminium industries and polymer technology. Integrated problems illustrating skills in process analysis. **(Old No. 3.136)**

CHEN4010 Multicomponent Separation Processes **S2 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. **(Old No. 3.143)**

CHEN4020 Advanced Reaction Engineering **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 intra-particle 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. **(Old No. 3.142)**

CHEN4030 Safety and Environmental **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. **(Old No. 3.145)**

CHEN4040 Management **S2 L2**

Prerequisite: CHEN3060

A workshop comprising exercises and case studies to introduce the human and organizational aspects of managing process or engineering enterprises. Includes discussion of typical organization structures and reasons for choosing them; problems of managing people in organizations, industrial relations questions. **(Old No. 3.147)**

CHEN4050 Process Plant Operation **S1 L1 T2**

Prerequisite: All 3rd year subjects

Practical studies of the operation of computer controlled chemical plant. Process diagnostics. Troubleshooting. **(Old No. 3.146)**

CHEN4060 Process Plant Engineering 2 **S1 L2 T2**

Prerequisites: CHEN3020, 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. **(Old No. 3.144)**

CHEN4070 Process Dynamics and Control **S1 L2 T1 S2 L1 T1**

Prerequisites: CEIC3010, CHEN3020, CHEN3070, MATH 2021.

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. **(Old No. 3.141)**

CHEN4080 Design Project **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. **(Old No. 3.148)**

CHEN4090 Research Project **F T6**

Prerequisites: All Year 3 subjects.

The experimental investigation of some aspect of chemical engineering. **(Old No. 3.140)**

CHEN4100 Professional Electives **F L2 T2**

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

Advanced Process Control

which will be offered by the relevant Schools or Departments. **(Old No. 3.149)**

INDC1010 Industrial Chemistry I **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. **(Old No. 3.210)**

INDC2010 Mass and Energy Balances **S1 L1 T1**

Prerequisites: CHEM1101, INDC1010, MATH1032.

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. **(Old No. 3.221)**

INDC2020 Introduction to Fluid Flow **S1 L1 T1**

Prerequisites: PHYS1002, MATH1032.

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. **(Old No. 3.220)**

INDC2030 Heat Transfer and Temperature Measurement **S2 L1 T1**

Prerequisites: PHYS1002, MATH1032.

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. **(Old No. 3.222)**

INDC3010 Thermodynamics **S1 L2 T1**

Co- or prerequisite: CHEM2011

Review of first law of thermodynamics; thermochemistry; second law of thermodynamics. Auxiliary functions and conditions of equilibrium. Thermodynamic properties of fluids; thermodynamic properties of homegeneous mixtures. Chemical reaction equilibria; calculation of equilibrium compositions for single reactions. Phase equilibria; the phase rule, equilibrium. **(Old No. 48.135)**

INDC3020 Industrial Chemistry 2B **S2 L2 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 and a course on electrochemical kinetics. **(Old No. 48.138)**

INDC3030 Experimental Design **S2 L1 T1**

Prerequisite: MATH2819

Design of experiments, correlation and regression, quality control. Use of graphical methods, fitting empirical equations to experimental data. Preparation of nomograms using constructional determinants. **(Old No. 48.139)**

INDC3040 Corrosion in the Chemical Industry **S2 L1 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. Design factors for corrosion prevention. Methods of corrosion prevention. **(Old No. 48.121)**

INDC3050 Chemistry of High Temperature Materials **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. **(Old No. 48.171)**

INDC3060 Industrial Chemistry 2A **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. **(Old No. 48.137)**

INDC3070 Instrumentation and Process Control 1 **S2 L2 T1**

Prerequisites: MATH2021, CEIC2010 or CHEM2041. Co- or prerequisite: INDC3090.

Analog Computation: theory and application of basic analog computing elements; magnitude and time scaling; solution of linear differential equations. *Instrumentation:* theory and application of transducers and transmitters for measurement of process variables. *Process Dynamics:* behaviour of linear, lumped paramater dynamics systems; first, second and higher order and integrating systems. *Process Control:* closed loop, block diagrams, controllers and controller tuning. **(Old No. 48.163)**

INDC3080 Instrumental Analysis 2 **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. **(Old No. 48.172)**

INDC3090 Chemistry of Industrial Processes **F L1 T2**

Prerequisite: CHEM2011. Co-or 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 enthylene and acetylene, elastomers. Laboratory: students are required to attend lectures on report writing, carry out laboratory assignments and attend factory inspections at local and country centres as required. **(Old No. 48.113)**

INDC4010 Applied Thermodynamics **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. **(Old No. 48.134)**

INDC4020 Applied Kinetics **S1 L1 T1**

Prerequisites: INDC3020, CEIC3010.

Adsorption theory, kinetics of catalytic and non-catalytic fluid-solid reactions, rates of surface reaction, kinetics of heterogenous reactions affected by diffusion, catalyst characterization. **(Old No. 48.124)**

INDC4070 Laboratory Automation Science **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. **(Old No. 48.165)**

INDC4080 Seminar **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. **(Old No. 48.174)**

INDC4090 Project (Industrial Chemistry) S1 T8 S2 T16

An experimental or technical investigation related to some aspect of industrial chemistry. Prerequisites and/or co-requisites will be determined depending on the nature of the project. **(Old No. 48.194)**

INDC4100 Industrial Electrochemistry S1 or S2 L2

Prerequisites: INDC3090, INDC3020.

Fundamentals of electrodes, the Butler-Volmer 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. **(Old No. 48.115)**

INDC4110 Water Chemistry 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. **(Old No. 48.116)**

INDC4120 Chemistry of the Industrial Environment 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. **(Old No. 3.421)**

Servicing Subjects

These are subjects taught within courses offered by other faculties.

For further information regarding the following subjects see the Combined Sciences Handbook. **(Old No. 48.194)**

CEIC0010 Mass Transfer and Material Balances FL1T1

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. **(Old No. 3.431)**

CEIC0020 Fluid/Solid Separation 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. **(Old No. 3.137)**

CEIC0030 Environmental Protection in the Process Industries SSL3T3

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. **(Old No. 3.4A)**

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:

a.1 Advanced treatment methods (water)
a.2 Advanced treatment methods (air)
a.3 Hazardous wastes
a.4 Computer-aided risk assessment
a.5 Advanced laboratory
a.6 Occupational Health Laboratory

POLY0010 Polymer Materials **S1 2 S2 4**

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. **(Old No. 48.412)**

Department of Fuel Technology

FUEL0010 Fuel Engineering (Mining and Mineral Processing Engineers) **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. **(Old No. 3.301)**

FUEL0020 Fuels and Energy **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. **(Old No. 3.302)**

FUEL0030 Fuel Science for Industrial Chemists **S1 or S2 L2**

Combustion science, mechanisms of major oxidation reactions, flames, mechanism of formation of carbon, NOx and SOx. Measurements of gas flow, gas composition, temperature in flames and furnaces. H-t relationships and their application. **(Old No. 3.303)**

FUEL0040 Fuel Engineering for Ceramic Engineers **F L1**

An introduction to combustion technology, combustion calculations, burner design, furnace, kiln and boiler thermal design. **(Old No. 3.304)**

FUEL3010 Fuel and Energy Engineering 1 **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. **(Old No. 3.331)**

FUEL4010 Fuel and Energy Engineering 2 **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. **(Old No. 3.341)**

FUEL4090 Fuel and Energy Research Project **F T6**

Investigation of some aspect of fuel engineering. **(Old No. 3.340)**

Department of Polymer Science

POLY3010 Polymer Science **F L2 T1**

Prerequisites: CHEM2011, CHEM2021, MATH2021, MATH2819. Co-or prerequisites: INDC3090.

Polymerization chemistry and processes. Step and radical chain polymerization. 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. **(Old No. 48.403)**

POLY4010 Advanced Polymer Science **S1 or S2 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. **(Old No. 48.404)**

Graduate Study

Centre for Petroleum Engineering Studies

PTRL5002 Drilling & Production Laboratory

Drilling and mud chemistry and rheology. The design of drilling fluids and their applications. Measurement of basic properties. Analysis and evaluation of petrophysical parameters. **(Old No. 20.305G)**

PTRL5003 Well Pressure Testing

Theory of transient well testing. Practical aspects of design and performance of field test instrumentation. Pressure build-up tests. Pressure draw-down tests. Fall-off tests. Multirate tests. Gas well testing. Flow-after-flow. Isochronal and Isochronal modified. Interference testing. Pulse testing. Drillstem tests. **(Old No. 20.410G)**

PTRL5004 Reservoir Simulation Fundamentals

Formulation of reservoir simulation equations. Explicit and implicit solution procedures. Cartesian and radial geometry. Single dimensional, two-phase flow. Description and use of commercial reservoir simulation software. Planning and execution of reservoir simulation projects. Effective use of reservoir simulation as a management and development tool. **(Old No. 20.406G)**

PTRL5006 Well Drilling & Completions

Rotary drilling hydraulics. Factors affecting rate of penetration. Directional drilling. Fishing operations. Coring. Formation damage. Casing design. Cementing. Gun perforating. Acidizing. Fracturing. Surfactants for remedial treatment. Sand control. **(Old No. 20.303G)**

PTRL5007 Reservoir Engineering

Basics of phase behaviour, equation of state modelling of gas-liquid systems, reservoir material balances. Identification of major recovery drive mechanisms. Water influx calculations. Well productivity. **(Old No. 20.309G)**

PTRL5008 Petroleum Production Economics

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. **(Old No. 20.306G)**

PTRL5010 Practical Assignment

A work experience assignment involving the equivalent of 280 hours work over a two month period in the oil industry. Suitable work assignments are arranged through the Centre for Petroleum Engineering in co-operation with industry. Students are required to complete a comprehensive report describing the work carried out. Assessment is based on the report submitted by the student and a student evaluation report by the student's immediate supervisor in the workplace. **(Old No. 20.501G)**

PTRL5011 Production Engineering

Well inflow performance. Simple and multiphase flow in horizontal, vertical and inclined pipe. Choke performance. Natural flow. Methods and design of artificial lift systems. Gas lift. Pluner lift. Sucker rod pumping. Hydraulic pumping. Jet pumping. Electric submersible pumps and others. Surface facilities. **(Old No. 20.403G)**

PTRL5105 Formation Evaluation

Theoretical/practical course in log analysis and its relation to other sources of subsurface data. Petrophysical data integration. Study of basic formation parameters and their well log responses. Data handling by computer. Evaluation of results. Case histories of Australian reservoirs. **(Old No. 20.411G)**

PTRL5109 Petroleum Engineering Project

An applied research project on a field problem 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. **(Old No. 20.409G)**

Chemical Engineering and Industrial Chemistry

General

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 **S1 or 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. **(Old No. 48.063G)**

CEIC5700 Process Principles

Material and energy balances and their application in chemical combustion processes. Introduction to rate process theory. Applications of equilibria. Principles of analysis. **(Old No. 48.070G)**

CEIC5810 Advanced Process Dynamics

Distributed-Parameter Linear Systems: Selected distributedparameter 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. **(Old No. 48.081G)**

CEIC5820 Process Optimization

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. **(Old No. 48.082G)**

CEIC5840 System Simulation and Control

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 data-logging, sequencing control. **(Old No. 48.084G)**

CEIC5850 Interphase Mass Transfer

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. **(Old No. 48.085G)**

CEIC5860 Fluid Particle Interactions

Fundamentals. Particle drag in an infinite laminar fluid, effect of turbulence and acceleration. Drag and rotation in shear flow. Multiparticular 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 co-current fluid-particle systems. Gas-fluidized beds. Gross behaviour, bubblephase theories, instability theories, grid-bed geometry and resistance relationships, elutriation, residence-time and size-distribution studies. Heat and mass transfer; design of catalytic and non-catalytic fluidized reactors. **(Old No. 48.086G)**

CEIC5890 Graduate Colloquia

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. **(Old No. 48.089G)**

CEIC5900 Specialist Lectures (Old No. 48.090G)

CEIC5910 Advanced Thermodynamics

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:* partiton 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. **(Old No. 48.091G)**

CEIC5920 Computer-aided Design

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. **(Old No. 48.092G)**

CEIC5930 Safety in Laboratories 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. **(Old No. 48.093G)**

INDC5310 Catalysts and Applied Reaction Kinetics 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. **(Old No. 48.131G)**

INDC5500 Instrumental Analysis for Industry 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 feed-back. Case studies for selected processes in relation to selecting the analytical method. **(Old No. 48.150G)**

INDC5610 Electrochemical Techniques for Control and Analysis S1 or S2 L2 T4

In-depth 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. **(Old No. 48.161G)**

Department of Fuel Technology

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

FUEL5800 Fuel Seminar

1 (SU) to be given in Session 2, compulsory in MAppSc degree course in Fuel Engineering. Content bias to choice of G subjects. **(Old No. 3.380G)**

FUEL5820 Fuel Constitution

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.
(Old No. 3.382G)

FUEL5830 Fuel Processing

Unit 1 2 (SU) Carbonization and gasification processes.
Unit 2 1 (SU) Liquid fuels from coals.
Unit 3 1 (SU) Chemicals from coals. **(Old No. 3.383G)**

FUEL5840 Fuel Plant Engineering

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.
(Old No. 3.384G)

FUEL5850 Combustion and Energy Systems

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.
(Old No. 3.385G)

FUEL5860 Unit Operations in Waste Management C3

Unit 1 (3 SU) The unit operations and processes associated with modern waste management practices, ie the origin, nature, characterization, handling, transportation, size reduction and storage of various waste materials; reduction at source and disposal by composting, landfill, incineration and chemical processing; recovery and re-use of marketable products. Case histories. **(Old No. 3.386G)**

FUEL5881 Unit Operations in Wastewater, Sludge and Solid Waste Management

Physical wastewater treatment processes including sedimentation, flotation, flocculation, procipitation. Sludge management including conditioning, filtering, lagoons, drying. Introductory fuel engineering. Combustion principles. Incineration. Pyrolysis. Gasification. Resource recovery and recycling. Incinerator and afterburner design. **(Old No. 3.388X)**

FUEL5870 Fuel Technology Practice

Compulsory in MAppSc (Fuel) (4 SU). Content bias towards choice of G subjects. **(Old No. 3.387G)**

FUEL5910 Atmospheric Pollution and Control (Theory) S1 or S2 L3

Causes, properties, dispersion, measurement and monitoring control and legislation of air pollution in ambient and industrial environments. **(Old No. 3.391G)**

FUEL5911 Atmospheric Pollution and Control (Theory) S1 or S2 L3

Causes, properties, dispersion, measurement and monitoring, control and legislation of air pollution in ambient and industrial environments. **(Old No. 3.391X)**

FUEL5920 Practical Aspects of Air Pollution Measurement and Control S1 or S2 T3

Prerequisite: FUEL5910 or equivalent.

Laboratory and tutorial programs in the measurement and analysis of ambient and industrial air pollutants. Computation tutorials in advanced dispersion models, aerosol dynamics and control equipment design parameters.
(Old No. 3.392G)

CEIC5000 Major Project

A substantial project on some aspects of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.
(Old No. 3.900G)

CEIC5010 Minor Project

A minor investigation on some aspect of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.
(Old No. 3.901G)

Department of Polymer Science

CEIC5000 Major Project

A substantial project on some aspects of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.
(Old No. 48.900G)

CEIC5010 Minor Project

A minor investigation on some aspect of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.
(Old No. 48.901G)

POLY5000 Polymer Science 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 conven tional 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. **(Old No. 48.400G)**

POLY5100 Analytical Characterization of Polymers **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. **(Old No. 48.410G)**

POLY5300 Polymer Engineering **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. **(Old No. 48.430G)**

POLY5400 Polymer Physics **S1 or S2 L4 T2**

Chain dimensions. Diffusion and viscosity. Segmental motion and the glass temperature Tg: factors affecting Tg. 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. **(Old No. 48.440G)**

School of Fibre Science and Technology

School of Fibre Science and Technology

Head of School
Associate 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 utilization 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 establishment of 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
Associate 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 specialized 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 sixty years and today it is one of our largest manufacturing groups. As in overseas countries, the impact of science 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 land-use still is grazing by sheep and cattle.

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

Staff

School of Fibre Science and Technology

Associate Professor and Head of School
Ross Ernest Griffith, BSc *N.S.W.*, PhD *Leeds*, CText, ATI

AWC Chair in Wool Technology
Vacant

Visiting Professor
Euan Maurice Roberts, MAgrSc N.Z., PhD *N.S.W.*

Project Scientist
Baden Singh Deol, MSc Panj., PhD *Syd.*

Administrative Officer
Douglas John Rose, BCom N.S.W., AACS, AIMM

Department of Textile Technology

Head of Department
Associate Professor Ross Ernest Griffith

Professor of Textile Physics
Ronald Postle, BSc *N.S.W.*, PhD *Leeds*, CText, FTI, FAIP

Associate Professor
Michael Thomas Pailthorpe, BSc PhD N.S.W., CText, FTI

Senior Lecturers
John Ilmar Curiskis, BSc PhD N.S.W., GAIP
Nigel Anthony Gull Johnson, BSc *N.S.W.*, PhD *Leeds*, CText, ATI

Lecturer
Shantha David, MSc Waik., PhD *Br.Col.*

Professional Officers
Jindrich Vavrinec Brancik, MSc *Brno*, PhD *N.S.W.*, MACS, FRSC
Rup Chand Dhingra, BSc *Punj.*, MTech *I.I.T.Delhi*, PhD *N.S.W.*, CText, FTI
Michael David Young, BSc PhD *N.S.W.*, CText, ATI

Department of Wool and Animal Science

Associate Professor and Head of Department
John Patrick Kennedy, MSc N.S.W., BSc *Oxf.*, FAIAS

Associate Professors
John William James, BA *Qld.*, DSc *N.S.W.*

Senior Lecturers
David John Cottle, BSc N.S.W., PhD *N.E.*
Stephen James Filan, BAgrEc *N.E.*, MSc *N.S.W.*, MAIAS*
Douglas McPherson Murray, BAgrSc PhD *Melb.*, MRurSc *N.E.*

Lecturer
Gordon Whitfield King, BSc PhD *N.S.W.*, DipFinMgt *N.E.*, MAIAS, AASA, CPA

Professional Officer
David John Petrie, BSc N.S.W.

Project Officer
Jeffrey Eppleston, MScAg Syd.

*Conjoint appointment with the School of Geography

Course Outlines

Undergraduate Study

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 $8,800 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.

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.

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.

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 specialize 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, except that the Advanced Textile Option is in the area of their own specialization.

Year 1 All options		**Hours per week** S1	S2
PHYS1002	Physics 1	6	6
CHEN1102	Chemistry 1A	6	0
CHEN1201	Chemistry 1B	0	6
FIBR1001	Natural Fibre Production	6	0
MATH1032	Mathematics 1	6	6
FIBR1101	Fibre Science 1	0	6
		24	24

Textile Chemistry

Year 2			
CHEM2011	Physical Chemistry	6	0
CHEM2021	Organic Chemistry	0	6
CEIC2010	Instrumental Analysis	3	3
MATH2819	Statistics SA	2	2
FIBR2201	Computing Applications	4	0
TEXT2101	Fibre Science 2	0	4
TEXT2301	Yarn Technology 1	0	6
TEXT2401	Fabric Technology 1	6	0
	General Education Elective	2	2
		23	23

Year 3		**Hours per week**	
CHEM3021	Organic Chemistry	6	0
Plus one of the following Chemistry electives			
CHEM2031	Inorganic Chemistry and Structure, *or*	0	6
CHEM3121	Synthetic Organic Chemistry, *or*	0	6
CHEM3321	Applied Organic Chemistry	0	6
or an alternative as approved by the Head of the School			
TEXT3101	Textile Structures 1	0	4
TEXT3201	Textile Quality Control	0	2
TEXT3301	Yarn Technology 2	6	0
TEXT3401	Fabric Technology 2	0	6
TEXT3501	Finishing Technology A	5	0
TEXT3601	Colour Science	3	0
TEXT3801	Textile Engineering 1	0	2
MANF0401	Production Management A	3	0
	General Education Elective	0	4
		23	24

Textile Physics

Year 2			
PHYS2001	Mechanics, Waves and Optics	4	0
PHYS2011	Electromagnetism and Thermal Physics	0	4
PHYS2021	Modern Physics	2	2
MATH2100	Vector Calculus	2.5	0
MATH2120	Mathematical Methods for Differential Equations	0	2.5
MATH2819	Statistics SA	2	2
FIBR2201	Computing Applications	4	0
TEXT2101	Fibre Science 1	0	4
TEXT2301	Yarn Technology 1	0	6
TEXT2401	Fabric Technology 1	6	0
	General Education Elective	2	2
		22.5	22.5

*Note: because of pre-requisite requirements students wishing to take certain year 3 electives may substitute PHYS2031 Laboratory in year 2, and take PHYS2021 Modern Physics in year 3.

Year 3			
PHYS2031	Laboratory *	3	3
Plus Physics electives averaging not less then 3 hours per session, selected from the following:			
PHYS2940	Introduction to Physics of Measurement	3	0
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	2
or an alternative as approved by the Head of the School			
TEXT3101	Textile Structures 1	0	4
TEXT3201	Textile Quality Control	0	2
TEXT3301	Yarn Technology 2	6	0
TEXT3401	Fabric Technology 2	0	6
TEXT3501	Finishing Technology A	5	0
TEXT3601	Colour Science	3	0
TEXT3801	Textile Engineering 1	0	2
MANF0401	Production Management A	3	0
	General Education Elective	0	4
		23	24

Textile Engineering

Year 2		**Hours per week**	
MECH1110	Graphical Analysis and Communication	0	3
MECH1300	Engineering Mechanics 1	4	0
ELEC0802	Electrical Power Engineering	0	3
ELEC0805	Electronics for Measurement and Control	3	0
CIVL0616	Structures	3	0
MATH2021	Mathematics	2	2
MATH2819	Statistics SA	2	2
FIBR2201	Computing Applications	4	0
TEXT2101	Fibre Science 2	0	4
TEXT2301	Yarn Technology 1	0	6
TEXT2401	Fabric Technology 1	6	0
	General Education Elective	0	4
		24	24

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 2	4	0
TEXT3201	Textile Quality Control	0	2
TEXT3301	Yarn Technology 2	6	0
TEXT3401	Fabric Technology 2	0	6
TEXT3501	Finishing Technology A	5	0
TEXT3601	Colour Science	3	0
TEXT3801	Textile Engineering 1	0	2
MANF0401	Production Management A	0	4
	General Education Elective	0	4
		24	24

Year 4 (All Options)			
TEXT4001	Textile Industry Studies	3	0
TEXT4003	Project	14	0
TEXT4013	Seminar	1.5	1.5
TEXT4101	Textile Structures 2	0	3
TEXT4201	Processing Laboratory	3	0
TEXT4501	Finishing Technology B	0	4
TEXT4601	Colouration Technology	0	4
Plus one advanced textile option			
TEXT4111	Advanced Textile Physics, or	0	2
TEXT4611	Advanced Textile Chemistry, or	0	2
TEXT4808	Textile Engineering 2	0	3
TEXT4811	Advanced Textile Engineering	0	2
MANF0402	Production Management B	0	3
or an alternative as approved by the Head of the School			
APSC0002	Social Issues and Applied Science	0	2
		21.5	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 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, Managerial Marketing.

Year 1		**Hours per week** S1	S2
PHYS1002	Physics 1, *or*	6	6
PHYS1022	Introductory Physics		
CHEM1101	Chemistry 1A		
CHEM1401	Introductory Chemistry, *or*	6	0
MATH1032	Mathematics 1, *or*	6	6
MATH1011	General Mathematics 1B *and*	6	0
MATH1021	General Mathematics 1C	0	6
ECON1101	Microeconomics 1	4	0
ECON1102	Macroeconomics 1	0	4
FIBR1101	Fibre Science 1	0	6
		22	22

Year 2			
MATH2819	Statistics SA	2	2
FIBR2201	Computing Applications	4	0
TEXT2101	Fibre Science 2	0	4
TEXT2301	Yarn Technology 1	0	6
TEXT2401	Fabric Technology 1	6	0
ACCT1501	Accounting and Financial Management 1A	4.5	0
ACCT1511	Accounting and Financial Management 1B	0	4.5
MARK2012	Marketing Systems	4	0
MARK2052	Marketing Research	0	4
	General Education Electives	2	2
		22.5	22.5

Year 3			
TEXT3101	Textile Structures 1	0	4
TEXT3201	Textile Quality Control	0	2
TEXT3301	Yarn Technology 2	6	0
TEXT3401	Fabric Technology 2	0	6
TEXT3501	Finishing Technology A	5	0
TEXT3601	Colour Science	3	0

TEXT3801Textile Engineering 102

Plus 2 Commerce electives selected from the following

ACCT2522	Accounting and Financial Management 2A	4.5	or	4.5

Year 3		**Hours per week**		
ACCT2542	Accounting and Financial Management 2B	4.5	or	4.5
ECON2103	Applied Microeconomics	3.5	or	3.5
ECON2301	Management and Business Development	3		0
INFS1602	Computer Information Systems 1	3	or	3
INFS2603	Computer Information Systems 2	0		3
MARK3073	Strategic Marketing	4		0
MARK3083	Managerial Marketing	0		4
IROB1701	Industrial Relations 1A	3.5	or	3.5
FINS2613	Business Finance 2A	3	or	3
LEGT7711	Legal Environment of Commerce	3	or	3
LEGT7731	Legal Regulation of Commerce	3	or	3
	or an alternative as approved by the Head of the School			
MANF0401	Production Management A	3		0
	General Education Elective	0		4
		20		20

Year 4			
TEXT4001	Textile Industry Studies	3	0
TEXT4003	Project	14	0
TEXT4013	Seminar	1.5	1.5
TEXT4101	Textile Structures 2	0	3
TEXT4201	Processing Laboratory	3	0
TEXT4501	Finishing Technology B	0	4
TEXT4601	Colouration Technology	0	4
TEXT4711	Advanced Textile Management	0	2
TEXT4801	Textile Engineering 2	0	3
MANF0402	Production Management B	0	3
or an alternative as approved by the Head of School			
APSC0002	Social Issues and Applied Science	0	2
		21.5	22.5

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 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, ie 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 manager of the property or the director of the institution as to the length of employment.

(2) Submit a written report along the guidelines which are available from the Department.

3220
Wool and Pastoral Sciences - Full-time Course

Bachelor of Science
BSc

Year 1		**Hours per week** S1	S2
CHEM1101	Chemistry 1A	6	0
CHEM1201	Chemistry 1B	0	6
FIBR1001	Natural Fibre Production	6	0
MATH1032	Mathematics 1 or	6	6
MATH1011	General Mathematics 1B and	6	0
MATH1021	General Mathematics 1C ,	0	6
FIBR1101	Fibre Science	0	6
BIOS1011	Biology A	6	0
BIOS1021	Biology B	0	6
		24	24

Year 2			
CHEM2929	Agricultural and Biological Chemistry	6	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
FIBR2201	Computing Applications	4	0
	General Education Elective	2	2
		25	24

Year 3			
WOOL3101	Animal Health and Welfare	3	0
WOOL3203	Pastoral Agronomy	4	4
WOOL3401	Animal Nutrition	0	4
WOOL3503	Wool Science 2	3	3
WOOL3803	Genetics 1	3	3
WOOL3901	Biostatistics 1	4	0
BIOC2312	Biochemistry	6	6
	General Education Elective	2	2
		25	22
Plus one of the three available options			
WOOL3111	Livestock Production 2	0	3
WOOL3211	Wool Marketing	0	3
WOOL4113	Crop Agronomy*	0	3
WOOL4711	Range Management*	0	3
		25	25

*Available in alternate years

Year 4			
WOOL4003	Project	6	6
WOOL4013	Seminar	2	2
APSC0002	Social Issues and Applied Science	0	2

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		**Hours per week** S1	S2
WOOL3111	Livestock Production 2	0	3
WOOL3211	Crop Agronomy*	0	3
WOOL3221	Range Management*	0	3
WOOL3511	Wool Marketing	0	3
WOOL4001	Rural Extension	4	0
WOOL4113	Livestock Production 3	3	3
WOOL4513	Wool Science 3	4	4
WOOL4711	Animal Health 2	3	0
WOOL4813	Genetics 2	4	4
WOOL4911	Biostatistics 2	0	4

* Available in alternate years.

Some subjects may not be offered in all years.

Group B

GEOG2021	Introduction to Remote Sensing	4	0
GEOG3032	Remote Sensing Applications	0	4
MARK2012	Marketing Systems	4	0
MARK2052	Marketing Research	0	4
BIOS3061	Environmental Botany	6	0
MICR2201	Introductory Microbiology	6	0

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

Graduate Study

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 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.

The Head of the Department is pleased to give information about research scholarships, fellowships and Department research activities. Graduates are advised to consult the Head of Department before making a formal application for registration.

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 comprizes both formal lectures and laboratory work, may be taken as a one year full-time course or two-year part-time course.

		Hours per week S1	S1
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	0	4
TEXT5201	Textile Quality Control	0	2
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	5	0
TEXT5402	Fabric Technology B	0	5
TEXT5501	Finishing Technology A	5	0
TEXT5502	Finishing Technology B	0	5
TEXT5601	Colour Science	4	0
TEXT5602	Dyeing Technology or an alternative as approved by the Head of School	0	4
		18	18

Candidates wishing to specialize 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 specialize 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 enquiries 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.

The Head of Department is pleased to give information about research scholarships, fellowships and Department research activities. Graduates are advised to consult the Head of Department before making a formal application for registration.

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 either in one year on a full-time basis or over two years on a part-time basis. Students are required to carry out full-time study or its equivalent 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:

		Hours per week
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 Arid Lands Management

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

- Range Management
- Management of Pastoral Enterprises

For course details see Graduate Study in the School of Geography section of the Applied Science Faculty handbook.

Subject Descriptions

Undergraduate Study

School of Fibre Science and Technology

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.

FIBR1001 Natural Fibre Production **S1 L3 T3**

Wool and other animal fibres: fibre and skin biology; mechanisms of, and factors affecting, fibre growth, fibre morphology; introduction to fibre production, harvesting, preparation for sale and marketing. Cotton: cotton growth; fibre morphology; factors affecting fibre growth; fibre production harvesting, handling and marketing.Production statistics and economics of natural fibre production in Australia contrasted to world fibre production. **(Old No. 9.510)**

FIBR1101 Fibre Science 1 **S2 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. **(Old No. 13.100)**

FIBR2201 Computing Applications **SS L2 T2**

Introduction to hardware and software concepts; Operating systems. Introduction to computer programming: simple algorithms and data organization. Computer applications in fibre science and technology: computer-aided design and manufacture CAD CAM; process monitoring and control, computer-integrated manufacture CIM; data acquisition; data analysis, statistical packages; modelling and optimisation techniques; databases, spreadsheets, text wordprocessing. **(Old No. 13.200)**

Department of Wool and Animal Science

WOOL2103 Livestock Production 1 **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. **(Old No. 9.111)**

WOOL2203 Agronomy **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 fertilizer usage. Weeds and weed control. Practical work in the systematics of selected plant families. **(Old No. 9.201)**

WOOL2303 Agricultural Economics and Management 1 **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. **(Old No. 9.301)**

WOOL2503 Wool Science 1 **F L2 T1**

Fibre structure; physical and chemical properties, variability of fibre properties. Physical fleece characteristics; fleece defects. Early stage processing and yarn manufacture. **(Old No. 9.501)**

WOOL2601 Animal Physiology 1 **S2 L3 T3**

Prerequisite: 17.041.

Physiology systems of mammalia are treated with special attention to homeostasis. Cell-membranes; blood and body fluids; the immune reaction. Cardiac control, functions and haemodynamics. Respiration. The endocrine system with particular emphasis upon growth, reproduction, lactation and stress. The nerve impulse, its excitation and transmission. Physiology of digestion, the gastro-intestinal tract and of the kidney. Heat tolerance and climatic adaptation. **(Old No. 9.601)**

WOOL3111 Livestock Production 2 **S2 L2 T1**

Prerequisite: 9.111.

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, eg feed lots, sea transport. **(Old No. 9.112)**

WOOL3203 Pastoral Agronomy **F L3 T1**

Prerequisite: 9.201.

Pasture ecology. Establishment, management and utilization 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. **(Old No. 9.202)**

WOOL3211 Crop Agronomy **S2 L2 T1**

Prerequisite: 9.201.

Field crop production associated with the pastoral industries. Crop physiology. Cropping practices. Pests and diseases. **(Old No. 9.203)**

WOOL3221 Range Management **S2 L1 T2**

Co or prerequisite: 9.202.

Basic range ecology and rangeland ecosystems. Plant physiology ! growth and development of rangeland plants. Rangeland management practices. Monitoring of long-terms 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. **(Old No. 9.204)**

WOOL3401 Animal Nutrition **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. Utilization 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. **(Old No. 9.421)**

WOOL3503 Wool Science 2 **F L2 T1**

Clip preparation. Wool metrology raw wool. Wool marketing procedures. Fabric manufacture, dyeing and finishing. **(Old No. 9.502)**

WOOL3511 Wool Marketing **S2 L2 T1**

Wool marketing systems; comparison with other countries, modelling. Wool commerce; financial factors. Information systems. Future directions. **(Old No. 9.504)**

WOOL3701 Animal Health and Welfare 1 **S1 L2 T1**

Prerequisite: 9.111.

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. **(Old No. 9.131)**

WOOL3803 Genetics 1 **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. **(Old No. 9.801)**

WOOL3901 Biostatistics 1 **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. **(Old No. 9.811)**

WOOL4001 Rural Extension **S1 L2 T2**

Development of communication skills through experiential or active learning situation. Educational, psychological and sociological factors relating to the diffusion of innovations. Program planning and evaluation. **(Old No. 9.901)**

WOOL4003 Project **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. **(Old No. 9.001)**

WOOL4013 Seminar **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 organizations. There are also seminars on communication in wool and pastoral sciences and on problems facing rural industries. **(Old No. 9.002)**

WOOL4113 Livestock Production 3 **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. **(Old No. 9.113)**

WOOL4513 Wool Science 3 **F L2 T2**

Evaluation and typing of wool. Topmaking and special processes. Wool metrology semi-processed and processed. Controlling mill quality control. The cashmere and mohair industries. Research developments. **(Old No. 9.503)**

WOOL4711 Animal Health 2 **S1 L2 T1**

Prerequisite: 9.131.

Use and misuse of products used in animal health work. Internal parasitism. External parasitism. Feedlot health. Transport health. Problems causing disease and death. Health of horses and dogs used in livestock management. **(Old No. 9.132)**

WOOL4813 Genetics 2 **F L2 T2**

Prerequisite: 9.801.

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. Genetic homeostasis, Genotype environment interaction.

Heterosis and its utilization. Interaction of natural and artificial selection. Limits of selective progress. **(Old No. 9.802)**

WOOL4911 Biostatistics 2 **S2 L2 T2**

Least squares methods, applied to multiple regression and experimental design models. Factorial experiments. Analysis of covariance. Elements of multivariate analysis. **(Old No. 9.812)**

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.

TEXT2101 Fibre Science 2 **SS 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 blended fibres and manmade fibres. Blended fibres. **(Old No. 13.201)**

TEXT2301 Yarn Technology 1 **SS L3 T3**

The preparation of staple fibres for yarns and non-woven fabrics: processes for tow conversion, opening, cleaning, blending, carding, drawing, and combing. Short-staple, worsted and woollen preparation systems. Computer blend selection; drafting theory; theory and measurememt of irregularity; levelling of slivers. **(Old No. 13.203)**

TEXT2401 Fabric Technology 1 **SS L3 T3**

Principles of weaving. Mechanisms of shedding, picking, and beating up. Secondary and auxilliary 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 represenation; basic weave structures. Leno and narrow fabric weaving, woven pile fabric constructions. Yarn preparation for weaving. Mechanics of woven fabric formation. Introduction to knitting technology. **(Old No. 13.204)**

TEXT3101 Textile Structures 1 **SS L2 T2**

Fibrous structures and textile assemblies. Fibre friction and viscoelasticity. Lubrication. Static electrification of textiles. Yarn structures. Fibre migration in yarns. Mechanics of continuous filament yarns, staple-fibre yarns, plied and textured yarns. Fabric testing; structure and dimensions; tensile strength; tear strength; fabric abrasion. Fabric low-stress mechanical and surface properties. Drape and handle. Fabric tailorability. **(Old No. 13.301)**

TEXT3201 Textile Quality Control **SS L T2**

User-seviceability testing. Fibre content and care-labelling. Process and quality control. Consumer problems. **(Old No. 13.300)**

TEXT3301 Yarn Technology 2 **SS L3 T3**

Properties of yarns. Introduction to geometry and mechanics of twisted structures. Staple yarm 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. **(Old No. 13.303)**

TEXT3401 Fabric Technology 2 **SS L3 T3**

Principles of knitting. Techniques of loop formation in weft and warp knitting; essential machine mechanisms. Knitted cloth construction principles and knitted structure representations; basic knitted structures. Techniques of jacquard needle selection and loop transfer for extended design effects in weft knitting; derivative weft knitted structures. Shaped weft knitted structures, including fully-fashioned knitting, hosiery manufacture, integral knitting techniques. Use of multiple guide bars, part-set threading, and auxillary mechanisms for extended design effects in tricot and raschel warp knitting; derivative warp knitted structures. Double needle bed warp knitting. Mechanisms of knitting fabric formation. Stitch-bonded and non-woven fabric manufacture. Tufting; recent developments in fabric forming technology. **(Old No. 13.304)**

TEXT3501 Finishing Technology A **SS 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 discoloration, 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. Manufacture, chemical constitution and properties of special purpose polymers. **(Old No. 13.305)**

TEXT3601 Colour Science **SS 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. **(Old No. 13.306)**

TEXT3801 Textile Engineering 1 **SS L2**

The application of engineering principles to textile machines and processes including elements of strength of materials; mechanics of solids; mechanical transmission of power; applied electricity; illumination design; process control. Analysis of engineering interactions in textile processes. **(Old No. 13.208)**

TEXT4001 Textile Industry Studies **SS L T3**

Econometrics of the textile and clothing industries. Models of production, import and export and consumption of textiles and clothing in Australia, and comparison with world data. Case studies in textile and clothing manufacture operations.

Environmental considerations in relation to pollution from the textile industry. Wastewater treatment methods. Biodegradable polymers. 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. **(Old No. 13.400)**

TEXT4003 Project **SS T14**

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. **(Old No. 13.480)**

TEXT4013 Seminar **F T1.5**

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. **(Old No. 13.470)**

TEXT4101 Textile Structures 2 **SS 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. **(Old No. 13.401)**

TEXT4111 Advanced Textile Physics **SS L2**

Varieties of macromolecules. Polymeric solids. Nature of water and water theories. Generalized structural mechanics of textile assemblies. Yarn bending properties. Development of torque in twisted yarns. Structure of complex knitted fabrics. Tensile properties of woven and knitted fabrics. Warp-knitted structures. Fabric bending properties. Fabric shear properties. Fabric objective measurement technology. **(Old No. 13.451)**

TEXT4201 Processing Laboratory **SS 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 outerwear fabric, etc. **(Old No. 13.460)**

TEXT4801 Textile Engineering 2 **SS L3 T1**

Thermodynamic principles and applications in textile processing including laws of thermodynamics; states and processes; fluid properties. Cycles and efficiency. Properties and use of steam. Air conditioning. Heat transfer. Flow of fluids. Energy use in textile processes. System dynamics in textile processes and procedures. **(Old No. 13.308)**

TEXT4501 Finishing Technology B **SS 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. **(Old No. 13.405)**

TEXT4601 Colouration Technology **SS L2 T2**

Classification of dyes and pigments and their methods of application. General properties of dyes, dyeing auxillaries 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. **(Old No. 13.406)**

TEXT4611 Advanced Textile Chemistry **SS L2**

Dyestuff aggregation in the dyebath and in the fibre. Fibre structure and dye sorption. Physical chemistry of dyeing; dyeing equilibria and dyeing kinetics of selected dye-fibre systems. **(Old No. 13.456)**

TEXT4711 Advanced Textile Management **SS L2**

Government policy in the textile, clothing and footwear industries. Production and marketing in the Australian environment. Case studies in management of textile operations. **(Old No. 13.457)**

TEXT4801 Textile Engineering 2 **SS L3 T1**

Thermodynamic principles and applications in textile processing including laws of thermodynamics; states and processes; fluid properties. Cycles and efficiency. Properties and use of steam. Air conditioning. Heat transfer. Flow of fluids. Energy use in textile processes. System dynamics in textile processes and procedures. **(Old No. 13.308)**

TEXT4811 Advanced Textile Engineering **SS L2**

Dimensional analysis and theory of similitude. Heat and mass transfer. Drying. Motion of particles in fluids. Pumps and fans. Mechanics of machines. **(Old No. 13.458)**

Graduate Study

Department of Wool and Animal Science

WOOL5113 Livestock Production **F L2 T4**

Biology of reproduction and reproductive performance of sheep and cattle; growth and body composition; meat production and quality. **(Old No. 9.105G)**

WOOL5213 Range Management **F L1 T3**

Objectives in the utilization 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 semi-arid 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. **(Old No. 9.205G)**

WOOL5223 Project in Range Management **F T9**

A theoretical and or experimental investigation of some aspect of management of rangelands. **(Old No. 9.206G)**

WOOL5513 Wool Science **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. **(Old No. 9.504G)**

WOOL5813 Animal Breeding **F L2 T2**

Co-requisite: 9.802.

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. **(Old No. 9.803G)**

WOOL5913 Quantitative Methods **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. **(Old No. 9.813G)**

Department of Textile Technology

TEXT5001 Textile Technology Dissertation **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. **(Old No. 13.727G)**

TEXT5003 Textile Technology **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. **(Old No. 13.717G)**

TEXT5101 Fibre Science A **SS 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. **(Old No. 13.711G)**

TEXT5102 Fibre Science B **SS 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 blended fibres and manmade fibres. **(Old No. 13.721G)**

TEXT5201 Textile Quality Control **SS L T2**

User-seviceability testing. Fibre content and care-labelling. Process and quality control. Consumer problems. **(Old No. 13.722G)**

TEXT5301 Yarn Technology A **SS 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 measurememt of irregularity; levelling of slivers. **(Old No. 13.713G)**

TEXT5302 Yarn Technology B **SS 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. **(Old No. 13.723G)**

TEXT5401 Fabric Technology A **SS L3 T2**

Principles of weaving. Mechanisms of shedding, picking, and beating up. Secondary and auxilliary 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 represenation; basic weave structures. Leno and narrow fabric weaving, woven pile fabric constructions. Yarn preparation for weaving. Mechanics of woven fabric formation. Introduction to knitting technology. **(Old No. 13.714G)**

TEXT5402 Fabric Technology B **SS L3 T2**

Principles of knitting. Techniques of loop formation in weft and warp knitting; essential machine mechanisms. Knitted cloth construction principles and knitted structure representations; knitted structures. Techniques of jacquard needle selection and loop transfer for extended design effects in weft knitting; derivative weft knitted structures. Shaped weft knitted structures, including fully-fashioned knitting, hosiery manufacture, integral knitting techniques. Use of multiple guide bars, part-set threading, and auxillary mechanisms for extended design effects in tricot and raschel warp knitting; derivative warp knitted structures. Double needle bed warp knitting. Mechanisms of knitting fabric formation. Stitch-bonded and non woven fabric manufacture. Tufting; recent developments in fabric forming technology. **(Old No. 13.724G)**

TEXT5501 Finishing Technology A **SS 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 discoloration, 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. Manufacture, chemical constitution and properties of special purpose polymers. **(Old No. 13.715G)**

TEXT5502 Finishing Technology B **SS L3 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. **(Old No. 13.725G)**

TEXT5601 Colour Science **SS 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. **(Old No. 13.716G)**

TEXT5602 Dyeing Technology **SS L2 T2**

Classification of dyes and pigments and their methods of application. General properties of dyes, dyeing auxillaries 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. Recent developments in dyeing and printing technology. **(Old No. 13.726G)**

School of Geography

School of Geography

Head of School
Professor B. J. Garner

Administrative Assistant
Ms. T. Bean

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.

Staff

Professor of Geography and Head of School
Barry Jardine Garner, BA *Nott.*, MA PhD *Northwestern*

Visiting Professor
Ronald Eyton, MS PhB *North Dakota*, MSPhD *Illinois*, AAS

Associate Professors
Ian Harry Burnley, MA Cant., PhD *Well.*
John Richard Dodson, MSc *Monash*, PhD *A.N.U.*
Anthony Kinnaird Milne, BA *N.E.*, MA *Syd.*, PhD *Colorado*

Senior Lecturers
Stephen James Filan, BAgEc *N.E.*, MSc *N.S.W.*
Marilyn Dale Fox, BSc *Windsor*, PhD *Macq.*
Michael Dick Melville, BScAgr PhD *Syd.*
Morgan Eugene Cyril Sant, BA *Keele*, MSc PhD *Lond.*
Andrew Kerr Skidmore, BSc PhD *A.N.U.*
Peter Leon Simons, BA PhD *Syd.*
Susanne Rae Walker, MA *Well.*, DPhil *Oxf.*

Lecturers
Wayne David Erskine, BA PhD *N.S.W.*
Bruno Peter John Parolin, BA *Monash*, MS *Oklahoma State*, PhD *Ohio State*, MIAG, MAAG, MRSA
Ian Phillip Prosser, BSc *N.S.W.*, PhD *A.N.U.*
Qiming Zhou, BSc *Beijing Normal*, PhD *N.S.W.*

Tutors
David John Edwards, BSc *N'cle (N.S.W.)*
Raya Gadir, BA DipEd *Hebrew Jerusalem.*, PhD *N.S.W.*
Beverley Ann Scott, BA *Macq.*
Kate Wilson, BSc *N.S.W.*

Administrative Assistant
Toni Bean

Course Outlines

Undergraduate Study

The three vocationally-oriented Applied Geography programs **3010** in the Faculty of Applied Science provide an analytical approach to understanding and investigating some of society's most pressing problems, including the use and management of scarce resources, the interaction between people and environment, soil erosion and conservation, land use conflicts, and spatial inequalities in economic and social well-being. These courses provide elective specialisations in physical geography (with special emphasis on either the biologic or geomorphic aspects), economic geography with emphasis on spatial analysis, and in human and physical resources (with emphasis on the integration of human and physical geography).

Geography is also available as a major sequence in the Arts course **3400,** where the emphasis is on the study of where and how people live, and on their activities in relation to the environment.

Major sequences in Science and Mathematics course 3970, programs **2700** and **6581** study the relationships between people and the physical environment, combining geographical studies, particularly in physical geography, with those in related disciplines, notably the biological and earth sciences.

Geography may also be combined with Civil Engineering in course **3730**, and with Law in course **4770.**

Students may enrol through the School of Geography for higher research degrees, or for formal graduate courses such as the Master of Applied Science in Land and Geographic Information Systems **8024**; Masters' and Diploma courses in Remote Sensing **8026** and **8056**, or Masters' and Diploma in Arid Lands Management **8025** and **5025**, 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 formal work, 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.

3010
Applied Geography - Full-time Course

Bachelor of Science
BSc

Students should consult the School before enrolling, as there may be some significant changes to these courses especially for Year 3 before the start of the 1991 teaching year.

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

Year 1		Hours per week S1	S2
MATH1011	General Mathematics 1B *and*	6	6
MATH1021	General Mathematics 1C *or*		
MATH1032	Mathematics 1 *or*		
MATH1042	Higher Mathematics 1	6	6
GEOG1012	Land Studies*	4	0
GEOG1022	Locational Processes	0	4
GEOG1031	Environmental Processes	0	4
GEOG1043	Data Processing Systems	2	2
GEOG1000	Field Project 1	0	3
and *either*			
ECON1101	Microeconomics 1 *and*	3.5	0
ECON1102	Macroeconomics 1 *and*	0	3.5
GEOG3202	Australian Social Environments	4	0
or			
BIOS1011	Biology A *and*	6	0
BIOS1021	Biology B	0	6
	or		
GEOL1101	Geological Processes**and	6	0
GEOL1201	Geological Environments**	0	6
		19.5/18	22.5/25

*Up to 5 days field work, equivalent to 40 tutorial hours, is an essential part of the subject.

**Up to 1 days of field tutorials in GEOL1101 and up to 3 days in GEOL1201 are essential parts of these subjects. Attendance is compulsory.

Note: Students will incur personal costs in connection with the field work component. Details will be provided at enrolment.

Applied Physical Geography

Year 2		Hours per week S1	S2
GEOG2013	Geographical Data Analysis	4	4
GEOG2021	Introduction to Remote Sensing	4	0
GEOG2032	Geomorphology	0	5
GEOG2000	Field Project 2	0	3
GEOG3172	Spatial Population Analysis*	0	4
and *either*			
CHEM1401	Introductory Chemistry A	6	0
or			
CHEM1101	Chemistry 1A	6	0
and *one*			
	General Education Subject (Category A)	0	4
and *either*			
GEOL2111	Earth Materials 1 *and*	6	0
GEOL2211	Earth Materials 2**	0	6
or any two of the following (one each session)			
BIOS2051	Flowering Plants	0	6
BIOS3111	Population and Community Ecology***	6	0
BIOS2031	Biology of Invertebrates	0	6
BIOS2061	Vertebrate Zoology	6	0
BIOS2021	Introductory Genetics	0	6
		19	19

*An alternative, selected from the Servicing Subjects in Geography listed in this handbook, may be substituted with the permission of the Head of School.

**Field work of up to 3 days, equivalent to 7 tutorial hours, is an essential part of this subject.

***May be taken in either Year 2 or Year 3.

Note: Students will incur personal costs in connection with the Field Project.

Year 3			
GEOG3000	Field Project 3	0	3
GEOG3082	Project Design and Formulation	0	4
GEOG3122	Geographic Information Systems	0	4
GEOG3011	Pedology	5	0
GEOG3021	Biogeography	0	5
GEOG3062	Environmental Change	0	4
and *one*			
	General Education Subject (Category B)	2	2
Plus two of the following			
GEOG3042	Environmental Impact Assessment	0	4
GEOG3032	Remote Sensing Applications	0	4
GEOG3051	Soils and Landforms	4	0
and *either*			
GEOG7321	Geology for Geomorphologists and Pedologists and	2	4
GEOL6231	Coastal Monitoring Techniques	3	3
or			
BIOS3061	Environmental Botany *and*	6	0
BIOS3111	Population *and* Community Ecology'	6	0
		19/18	16/25

'May be taken in either Year 2 or Year 3. MATH1032 or MATH1042 is a prerequisite.

Note: Students will incur personal costs in connection with the Field Project.

Applied Economic Geography

Year 2		Hours per week S1	S2
ECON2103	Applied Microeconomics'	4	0
ECON2104	Applied Macroeconomics'	0	4
GEOG2000	Field Project 2	0	3
GEOG2061	Regional Theory	4	0
GEOG2071	Transport and Land Use	4	0
GEOG2013	Geographic Data Analysis	4	4
GEOG2041	Mathematical Methods for Spatial Analysis	4	0
GEOG2052	Project in Spatial Analysis	0	4
GEOG3062	Environmental Change	0	4
and *one*			
	General Education Subject (Category A)	0	4
		20	20

'May be taken in either Session 1 or Session 2.
Note: Students will incur personal costs in connection with the Field Project.

Year 3			
GEOG3071	Computer Cartography	4	0
GEOG3000	Field Project 3	0	3
GEOG3042	Environmental Impact Assessment	0	4
GEOG3082	Project Design and Formulation	0	4
GEOG3092	Geographical Data Analysis*	0	4
GEOG3161	Sample Surveys and Questionnaire Design	4	0
GEOG3132	Marketing Geography	4	0
GEOG3141	Regional Population Analysis	4	0
GEOG3152	Social Welfare and Urban Development	0	4
and *one*			
	General Education Subject (Category B)	4	0
Plus *two* of the following subjects (one each session)**			
ECON3115	Economics of Developing Countries	3	0
ECON2107	Natural and Environmental Resources Economics	0	3
ECON3105	Public Economics A	3	0
ECON2108	Industry Economics and Australian Industrial Policy	0	3
ECON2110	Regional and Urban Economics	3	0
		23/24	22/23

*Not offered in 1991.
**One subject may be substituted for those listed with permission of Head of School.
Note: Students will incur personal costs in connection with the Field Project.

Human and Physical Resources

Year 2

		Hours per week S1	S2
GEOG2021	Introduction to Remote Sensing	4	0
GEOG2000	Field Project 2	0	3
GEOG2013	Geographical Data Analysis	4	4
GEOG2032	Geomorphology	0	5
GEOG2061	Regional Theory	4	0
and one			
	General Education Subject (Category A)	0	4
and one of the following			
GEOG3181	Urban Activity Systems**	4	0
GEOG3062	Environmental Change	0	4
and either			
ECON2104	Applied Macroeconomics***	0	4
and			
ECON2103	Applied Microeconomics***	4	0
and			
GEOG3333	Special Topic	0	4
or			
GEOL2111	Earth Materials 1 *and*	6	0
GEOL2211	Earth Materials 2**	0	6
or two of			
BIOS2051	Flowering Plants	0	6
BIOS2031	Biology of Invertebrates	0	6
BIOS2061	Vertebrate Zoology	6	0
		18/20	20/26

*An alternative, selected from the Servicing Subjects in Geography listed in this handbook, may be substituted with the permission of the Head of School.
**Field work of up to 3 days, equivalent to 7 tutorial hours, is an essential part of this subject.
***May be taken in either Year 2 or Year 3. MATH1032 or MATH1042 is a prerequisite.
Note: Students will incur personal costs in connection with the Field Project.

Year 3

GEOG3042	Environmental Impact Assessment	0	4
GEOG3000	Field Project 3	0	3
GEOG3071	Computer Cartography	4	0
GEOG3082	Project Design and Formulation	0	4
and *one*			
	General Education Subject (Category B)	2	2
Plus *four* of the following subjects			
GEOG3011	Pedology	5	0
GEOG3021	BiogeographyT5	0	
GEOG3032	Remote Sensing Applications	0	4
GEOG3101	Sample Surveys & Questionnaire Design	4	0
GEOG3122	Geographic Information Systems	0	4
GEOG3051	Soils and Landforms	4	0
GEOG3132	Marketing Geography	4	0
GEOG3141	Regional Population Analysis	4	0
GEOG3152	Social Welfare and Urban Development	0	4
and *either*			
ECON2110	Regional and Urban Economics	3	0
and			
ECON2107	Natural and Environmental Resource Economics	0	3
or			
GEOL7321	Geology for Geomorphologists and Pedologists	2	4
or one of			
BIOS3061	Environmental Botany	6	0
BIOS3111	Population and Community Ecology	6	0
		20/24	22/25

Note: Students will incur personal costs in connection with the Field Project.

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

Year 4

GEOG4010	Field Project	0	8
GEOG4021	Assessment of Human and Physical Resources*	4	0
GEOG4031	Project	16	0
GEOG4042	Practical Applications	0	3
GEOG4052	Advanced Spatial Analysis*	0	4
GEOG4062	Advanced Environmental Analysis	0	4
		20	19

*Up to two subjects may be substituted from those offered by the School of Geography, Department of Applied Geology or School of Biological Sciences, subject to approval by the Head of School.
Note: Students will incur personal costs in connection with project work in the final year of study.

Graduate Study

8024
Graduate Program in Land and Geographic Information Systems

Master of Applied Science
MAppSc

The Masters degree program in Land and Geographic Information Systems 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 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 (1 credit equals 1 hour per week for one session), 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		**Credits**
GEOG9240	Geographic Information Systems	3
COMP9311	Data Base Systems	3
SURV9604	Land Information Systems	3
SURV9532	Computer-Assisted Mapping	3
Elective Subjects		
GEOG9150	Remote Sensing Applications	3
GEOG9210	Computer Mapping and Data Display	3
GEOG9200	Image Analysis in Remote Sensing	3
LIBS0817	Information Storage and Retrieval Systems	6
LIBS0815	Economics of Information Systems	3
GEOG9250	Special Topic in Geography	3
ELEC9336	Digital Communication Networks 1	3
SURV9107	Special Topic in Surveying B	3

Project		**Credits**
GEOG9512	Project	12

Compulsory subjects not offered in a particular year, and other elective subjects than those listed, may be substituted by equivalent subjects approved by the Head of School.

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. 1 credit equals approximately 1 hour of class contact per week for one session. 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	3
GEOG9110	Soil Erosion and Conservation	3
GEOG9509	Project *OR*	9
WOOL5223	Project	9

Optional Subjects		**Credits**
Choose subjects totalling 15 credits from the following list.		
CIVIL9842	Groundwater Hydrology	3
CIVIL9875	Hydrological Processes	3
WOOL2103	Livestock Production I	6
WOOL3111	Livestock Production II	6
ECON2107	Natural and Environmental Resource Economics	3
GEOG9150	Remote Sensing Applications	3

GEOG9240	Geographic Information Systems	3
GEOG9100	Geomorphology of Arid Lands	3
GEOG9130	Soil Studies for Arid Lands Management	3
GEOG9140	Terrain Evaluation	3
BIOS3014	Ecological Studies in Arid Lands Management	3

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

5025
Rangeland Management Graduate Diploma Course

Graduate Diploma
GradDip

Compulsory Subjects		Credits
WOOL5213	Range Management	3
GEOG9110	Soil Erosion and Conservation	3

Optional Subjects		Credits
Choose subjects totalling 18 credits, to include at least 9 credits of graduate level subjects.		
CIVIL9842	Groundwater Hydrology	3
CIVIL9875	Hydrological Processes	3
WOOL2103*	Livestock Production 1	6
WOOL3111*	Livestock Production 2	3
WOOL4113*	Livestock Production 3	6
WOOL3203*	Pastoral Agronomy	6
ECON2107*	Natural and Environmental Resource Economics	3
GEOG3021*	Biogeography	3
GEOG2021*	Introduction to Remote Sensing	3
GEOG3051*	Soils and Landforms	3
GEOG3062*	Environmental Change	3
GEOG9240	Geographic Information Systems	3
GEOG9100	Geomorphology of Arid Lands	3
GEOG9130	Soil Studies for Arid Lands Management	3
GEOG9140	Terrain Evaluation	3
BIOS3014	Ecological Studies in Arid Lands Management	3

* Undergraduate level subjects.

Additional subjects may be substituted with the permission of the Course Co-ordinator.

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, and a project. Compulsory subjects not offered in a particular year may be substituted by an equivalent subject, approved by the appropriate Head of School. The degree will normally comprise one year of full-time study or two years of part-time study.

Compulsory Subjects		Credits
GEOG9150	Remote Sensing Applications	3
SURV9600	Principles of Remote Sensing	3
SURV9602	Remote Sensing Procedures	3
SURV9605	Ground Investigations for Remote Sensing	3
REMO9580	Image Analysis in Remote Sensing	3
REMO9581	Microwave Remote Sensing	3
Project		
GEOG9512	Project *OR*	12
GEOL0114	Project	12

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 (15 credits) and elective subjects (9 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		**Credits**
SURV9600	Principles of Remote Sensing	3
SURV9605	Ground Investigations for Remote Sensing	3
GEOG9170	Remote Sensing Instrumentation and Satellite Programs	3
GEOG9150	Remote Sensing Applications	3
REMO9580	Image Analysis in Remote Sensing	3

Elective Subjects

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

ELEC9408	Computer Display Systems and Interactive Instrumentation	3
CIVL9875	Hydrological Processes	3
CIVL9849	Irrigation	3
CIVL9861	Investigation of Ground Water Resources 2	3
CIVL9864	Arid Zone Hydrology	3
CIVL9865	Arid Zone Water Resources Management	3
GEOL9060	Environmental Geology	3
GEOL0200	Geology in Exploration 1	4
GEOL0110	Remote Sensing in Applied Geology	2
GEOL0150	Geology in Exploration 2	2
GEOG9160	Directed Problems in Remote Sensing	3
GEOG9210	Computer Mapping and Data Display	3
GEOG9240	Geographic Information Systems	3
GEOG9140	Terrain Evaluation	3
SURV9211	Introduction to Geodesy	3
SURV9213	Physical Meteorology	3
SURV9532	Computer Assisted Mapping	3
SURV9604	Land Information Systems	3
REMO9581	Microwave Remote Sensing	3

Graduate Program 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.

The subject matter covers a set of themes: resource use and conservation, pollution abatement, hazard perception and adjustment. Strong attention will be given to environmental impact assessment and conflict resolution.

The course is designed around three broad components for a total of 36 credits (1 credit = 1 hour per week per one session):

- Core subjects Research Project (6 credits)
- Project (9 or 18 credits)
- Electives(12 or 21 credits)

The core subjects and electives will consist of subjects specially designed together with appropriate subjects taken from those offered by a number of Faculties and Boards of Studies within the University of New South Wales. Prerequisites shall be determined by the relevant Subject Authority.

Core Subjects		**Credits**
GEOG9190	Environmental Planning and Evaluation	2
GEOG9260	Medical Aspects	2
GEOG9270	Legislative Aspects	2

Project

GEOG9518	Research Project	18
or		
GEOG9509	Project in Environmental Studies	9

Elective Subjects*

Earth Science - Engineering

MINE1524	Mining Conservation	3
CIVL9847	Water Resources Policy	3
CIVL9851	Unit Operations in Public Health Engineering	3
CIVL9858	Water Quality Management	3
CIVL9868	Public Health Science	3
GEOL3251	Engineering and Environmental Geology	6
GEOL9060	Environmental Geology	3
GEOL9027	Geopollution Management	3
GEOG9150	Remote Sensing Applications	3
GEOG3011	Pedology	5
GEOG9160	Directed Problems in Remote Sensing	3
GEOG9170	Remote Sensing Instrumentation and Satellite Programs	3
GEOG3042	Environmental Impact Assessment	4
GEOG9110	Soil Erosion and Conservation	3
GEOG9140	Terrain Evaluation	6
GEOG9220	Applied Geomorphology	6

*Chemistry - Biology**

CHEM3311	Environmental Chemistry	6
CHEM7325	Toxicology, Occupational and Public Health	6
GEOG3021	Biogeography	5
BIOS3061	Environmental Botany	6
CEIC5630	Industrial Water and Wastewater Engineering	3
INDC4110	Water Chemistry	3
FUEL5860	Unit Operations in Waste Management	3
FUEL5910	Atmospheric Pollution Control	3
FUEL5920	Practical Aspects of Air Pollution Measurement and Control	3

*Social-Economic-Planning**

CIVL9402	Transport, Environment, Community	6
GEOG9120	Settlement in Australia	3
GEOG9240	Geographic Information Systems	3
GEOG9210	Computer Mapping and Data Display	3
GEOG9230	Population, Health and Environment	2
IROB5901	Organization Behaviour A	3
PLAN3214	Environmental Psychology**	3
PLAN0911	Organisation of Town Planning	3
LAND9213	Land Systems and Management	4
LAND9010	Conservation Studies	3
LAND9111	Landscape Planning	3
GSBE1101	Community Noise Control	2
SOCI5306	Technology and Society	3
SOCI5316	Urban Studies	3
SOCI5309	Social and Technological Forecasting	3
MNGT0204	Resource Markets and Management	3
MNGT0385	Business ! Government Relations	3

*Other subjects may be added on approval of Course Co-ordinator.
** Not offered in 1991.

Subject Descriptions

Undergraduate Study

GEOG1000 Field Project 1 **S2 T3**

A five days field project normally undertaken during the mid-year 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. **(Old No. 27.100)**

GEOG1012 Land Studies **S1 L2 T2**

Concepts, significance and problems of land. Land as territory and land as resource in Australia. Constraints imposed by the physical environment on human occupancy and settlement patterns, the variety of conflicts that result and management strategies. Practical work involves study of the ways in which the attributes and characteristics of land are displayed on maps, air photos and satellite imagery, and introduces these as basic information sources and research tools in applied geography. **(Old No. 27.010)**

GEOG1022 Locational Processes **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. **(Old No. 27.020)**

GEOG1031 Environmental Processes **S2 L2 T2**

Excluded: GEOG1051, 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, to and movement of materials. **(Old No. 27.030)**

GEOG1043 Data Processing Systems **F T2**

Measurement, processing and display of spatial data. Basic knowledge and skills for using the University's computing system effectively; the use of computer software packages in geographic enquiry; exploratory data analysis and graphic information processing; and the presentation of data in tables, graphs and diagrams. **(Old No. 27.040)**

GEOG1051 Global Environmental Problems and Processes **S1 L2 T1**

Prerequisite: Nil

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 **S2L2T1**

Prerequisite: Nil

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 **S1 S2 T3**

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. **(Old No. 27.200)**

GEOG2013 Geographical Data Analysis **F L2 T2**

Prerequisite: Both GEOG1012 and GEOG1031 or both GEOG1051 and GEOG1062. Excluded GEOG2093, GEOG3221.

Inferential statistics and hypothesis testing in the analysis of spatial data. Methods of analysing categorical data, identifying spatial correlation and associations, and multivariate methods applicable to topics in physical and economic geography. **(Old No. 27.050)**

GEOG2021 Introduction to Remote Sensing **S1 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. **(Old No. 27.175)**

GEOG2032 Geomorphology **S2 L2 T3**

Prerequisites: GEOG1031 or GEOG1051 or GEOL1201.

Hillslope materials, processes and form; models of slope and landscape evolution. Fluvial geomorphology including water movement and sediment transport in river channels, hydraulic geometry, channel patterns, river types, flood plain formation, alluvial fans, river channel changes. Erosional and depositional landforms in coastal, arid, humid and glacial environments.

Field work in fluvial and hillslope geomorphology, and laboratories on field measurements of geomorphic processes, sediment analyses and airphotograph interpretation. **(Old No. 27.183)**

GEOG2041 Mathematical Methods for Spatial Analysis **S1 L1 T3**

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. **(Old No. 27.500)**

GEOG2052 Project In Spatial Analysis **S2 L1 T3**

Prerequisite: GEOG2041

Supervised application of quantitive 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. **(Old No. 27.510)**

GEOG2061 Regional Theory **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. **(Old No. 27.520)**

GEOG2071 Transport and Land Use **S1 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. **(Old No. 27.672)**

GEOG2081 Australian Environmental Problems **S1L2T2**

Prerequisite: GEOG1051 or GEOG1031

The nature of the Australian environment is outlined and selected major environmental problems are considered. The nation's landforms, soils and vegetation are described and considered in relation to the patterns of climate and land-use to appreciate how the problems of drought, bushfires, salinisation, soil acidification, loss in species diversity and land degradation arise. Options for abatement and tolerance are discussed as appropriate.

GEOG2092 Australian Social and Economic Landscapes **L2 T2**

Prerequisite: GEOG1062 or GEOG1012

Not offered in 1991.

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 reorganisation are emphasised and future scenarios addressed.

GEOG2093 Geographic Methods **S2 L2 T2**

Prerequisites: Both GEOG1012 and GEOG1031 or both GEOG1051 and GEOG1062.
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. **(Old No. 27.813)**

GEOG2102 Environmental Issues in Australia **L2T1**

Prerequisite: GEOG1051 or GEOG1062

Not offered in 1991.

Selected issues in Australia demonstrating the impacts of economic growth and development on the natural environment including a consideration of the ways in which economic forces and political factors affect the exploitation and carrying capacity of natural systems. Case studies taken from tourist developments, forestry, agriculture and land degradation, suburbanization, water quality and use, and power generation. Emphasis is placed on the philosophical and factual arguments for environmentally sound planning and resource management practices.

GEOG3000 Field Project 3 **S1 S2 T3**

Prerequisite: One of GEOG3011, GEOG3021, GEOG2032. This prerequisite does not apply to studentgs registered in course 3010.

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. **(Old No. 27.300)**

GEOG3011 Pedology **S2 L2 T3**

Prerequisites: GEOG1031 or GEOG1051 and one of CHEN1292 or CHEM1492 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. **(Old No. 27.133)**

GEOG3021 Biogeography **S1 L2 T3**

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. **(Old No. 27.143)**

GEOG3032 Remote Sensing Applications **S2 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. **(Old No. 27.176)**

GEOG3042 Environmental Impact Assessment **S2 L2 T2**

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

Rationale and basic objectives; standardized types of environmental impact assessment EIA, including matrix approach, adopted methods of EIA in Australia. Frequently used assessment and predictive techniques for meteorological, hydrological, biological, socio-economic impacts. 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. **(Old No. 27.193)**

GEOG3051 Soils and Landforms **S1 L2 T2**

Prerequisite: GEOG3011 or GEOG2032 or GEOG2081 or by permission from Head of School.

Organization of soil material: stratigraphic layers versus profiles. Models of soil formation zonal, leaching and landscape approaches. Australian and international soil classification systems. Soil development on hillslopes: texture contrast soils. Floodplain landforms: river terraces and chrono-sequences. Lithoand chrono-stratigraphic use of soils in residual aeolian, fluviatile and coastal deposits. **(Old No. 27.213)**

GEOG3062 Environmental Change **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. **(Old No. 27.223)**

GEOG3071 Computer Cartography **S1 L2 T2**

Theoretical and practical problems in producing thematic maps by computer. Effective use of colour and shading on thematic maps. Design principles. Data entry and digitising. Production of multiple feature displays. Use of symbolism. Emphasis on developing skills in computer cartography through hands-on experience using GIMMS. **(Old No. 27.431)**

GEOG3082 Project Design and Formulation **S2 L1 T3**

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. **(Old No. 27.503)**

GEOG3092 Geographic Data Analysis 3 **S2 L2 T2**

Advanced methods for spatial analysis; case studies; selected topics in applied economic geography with particular reference to urban and regional analysis and planning. **(Old No. 27.633)**

GEOG3101 Sample Surveys and Questionnaire Design **S1 L2 T2**

Explanation and prediction as distinct research objectives; designing research to achieve reliability and validity; case studies in research design; questionnaire design and implementation; scaling methods; interviewing techniques; sampling problems; directions in Qualitative Research. **(Old No. 27.643)**

GEOG3122 Geographic Information Systems **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. **(Old No. 27.652)**

GEOG3132 Marketing Geography **S2 L2 T3**

Prerequisite: MARK2042 Note: *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 intra-urban areas. Consumer spatial behaviour, including search and decision processes. Shopping centre images and spatial choice models. **(Old No. 27.713)**

GEOG3141 Regional Population Analysis **S1 L2 T2**

The primary emphasis is on regional population estimation and forecasting with reference to Australian conditions and the use of Australian data. The population forecasting is handled within the framework of demographic theory and component analysis; migration analysis is given particular attention; multi-region population models; hybrid methods of small area population

forecasting; use of population profiles for planning the provision of services. **(Old No. 27.743)**

GEOG3152 Social Welfare and Urban Development **S1 L2 T2**

Prerequisite: GEOG1012 or GEOG3202 Note: 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. **(Old No. 27.753)**

GEOG3161 Computer Mapping and Data Display **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. **(Old No. 27.432)**

GEOG3172 Spatial Population Analysis **S2 L2 T2**

Prerequisite: GEOG3202 or GEOG1012.

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. **(Old No. 27.824)**

GEOG3181 Urban Activity Systems **S1 L2 T2**

Prerequisite: GEOG3202 or GEOG1012.

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. **(Old No. 27.825)**

GEOG3192 Urban and Regional Development **S2 L2 T2**

Prerequisite: GEOG3202 or GEOG1012.

Theories of urban and regional change leading to assessment of the role of planning. Emphasis on resource allocation, conflict resolution and evaluation techniques including cost-benefit analysis and environmental impact assessment. Examples are taken principally from the fields of recreation and tourism. **(Old No. 27.826)**

GEOG3202 Australian Social Environments **S1 L2 T2**

Prerequisite: GEOG1012 or GEOG1062.

Focus is on the interaction between human communities and the built environment in Australia: the effects of the natural environment on the evolution of settlement patterns; detailed analysis of rural and metropolitan social environments. Emphasis on inner city, suburbia, behavioural and social area approaches, and to managerialist and structural theories of social change on areas and their communities. **(Old No. 27.829)**

GEOG3211 Australian Environment and Natural Resources **S1 L2 T2**

Prerequisite: GEOG2032 or GEOG1051.

Continental and regional patterns of land, water and energy resources in Australia and its territorial waters, and natural factors affecting their development, including climate, soils and terrain; problems of limited surface and underground water resources and of conflicting demands, exemplified through particular basin studies; comparable reviews of energy, minerals and forest resources, human resources and development. **(Old No. 27.862)**

GEOG3221 Advanced Geographic Methods **S1 L2 T2**

Prerequisites: GEOG2093. 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. **(Old No. 27.884)**

GEOG3333 Special Topic **S1 or S2 T4**

Prerequisite: Nil.

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. **(Old No. 27.883)**

GEOG4010 Field Project **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. **(Old No. 27.180)**

GEOG4021 Assessment of Human and Physical Resources **S1 L4 T4**

Assessments of human and physical resources and environments. Specialised study in the following areas: landforms, soils, vegetation, climate and water, resource planning and decision making, human resources, geographical thought and perspectives. Since the units offered in any one year may be affected by the availability of staff, students should obtain information from the School. **(Old No. 27.190)**

GEOG4031 Project **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. **(Old No. 27.504)**

GEOG4100/GEOG4050 Honours Geography **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. **(Old No. 27.844)**

GEOG4042 Practical Applications in Geography **S2 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. **(Old No. 27.514)**

GEOG4052 Advanced Spatial Analysis **S2 L2 T2**

Selected topics in economic and physical geography chosen to illustrate developments at the frontiers of research in spatial analysis. **(Old No. 27.524)**

GEOG4062 Advanced Environmental Analysis **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. **(Old No. 27.534)**

Graduate Study

GEOG9100 Geomorphology of Arid Lands S1 L2 T4 C6

Physiugraphic, geologic and climatic determinants of arid landforms and landforming processes. Rock weathering and weathering products under arid environments. Desert hillslopes and hillslope processes. Geomorphic aspects of runoff on desert hillslopes and the initiation of channel networks; characteristics of desert drainage nets. Geomorphic aspects of desert streamfloods; forms of desert channels and floodplains. Desert playa regimes and the associated features of desert lake basins. Transport of sand and dust by wind and related aeolian landforms and surfaces. Inheritance in desert landscapes and geomorphic evidence of climatic change. Geomorphic aspects of accelerated wind and water erosion in deserts. Exercises in the phoot-interpretation of desert landforms and in related geomorphic mapping. **(Old No. 27.910G)**

GEOG9110 Soil Erosion and Conservation S1 or S2 L2 T4 C6

Climatic, vegetational, geomorphic and pedologic controls of erosion. Physical processes of sediment transport and deposition. Conservational measures for the prevention of erosion including constructional and managmeent practices. Methods of assessing soil loss risk and erosion hazard evaluation. **(Old No. 27.911G)**

GEOG9130 Soil Studies for Arid Lands Management S1 or S2 L2 T4 C6

Soil forming processes in arid regions. Physical, ineralogical 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 alkalinization. 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. **(Old No. 27.913G)**

GEOG9140 Terrain Evaluation S1 L2 T4 C6

Principles and techniques for natural resource surveys and land evaluation including: land systems, terrain patterns, land capability and economic aspects of evaluation; examination of mapping, taxonomic and descriptive units; the problem of map scale and accuracy; styles of presentation for practitioners and other uses. Application of principles in selected other contexts. **(Old No. 27.914G)**

GEOG9150 Remote Sensing Applications S1 L1 T2 C3

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. **(Old No. 27.043G)**

GEOG9160 Directed Problems in S2 T3 C3

Remote Sensing

A detailed investigation of a particular aspect of remote sensing technology or an area of applications relevant to candidates interests and background. **(Old No. 27.171G)**

GEOG9170 Remote Sensing Instrumentation and Satellite Programs S1 L2 T1 C3

Aircraft and satellite platforms; sensor types; image formation and end products including panchromatic, colour, colour IR and thermal IR photographic products, microwave imagery and computer tape products. The organization, acquisition, processing and analysis of imagery obtained from the following satellite programs: Landsat, Skylab, Heat Capacity Mapper Mission, Nimbus Coastal Zone Color Scanner, Seasat, Space Shuttle, Spot and Soyuz-Salyut.

GEOG9180 Environmental Planning and Evaluation C2

Seminars on environmental problems, socio-economic assessment of policies and proposed developments, resource management. **(Old No. 27.174G)**

GEOG9210 Computer Mapping and Data Display C3

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, **(Old No. 27.644G)**

GEOG9220 Applied Geomorphology S2 L1.5 T0.5 C3

Landform expression of lithology and structure. Hillslope, drainage basin and channel forms and processes. Landform evolution, short-term and long-term geomorphic changes. Geomorphological background to soil erosion, stream channel, floodplain and coastal engineering problems. Geomorphological approach to terrain evaluation. Exercises in airphoto and map analysis of fluvial landforms or terrain types. Field excursion on fluvial landform or terrain assessment, as required. **(Old No. 27.922G)**

GEOG9230 Population, Health and Environment C2

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. **(Old No. 27.923G)**

GEOG9240 Geographic Information Systems **C3**

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. **(Old No. 27.672G)**

GEOG9509 Project **S2 T9 C9**

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. **(Old No's. 27.950G/46.101G)**

GEOG9512 Project **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. **(Old No. 46.102G)**

GEOG9518 Research Project **F T9 C18**

As for GEOG9509 Project, but involving more substantial research over a longer period. Tutorial hours are equivalent contact hours, but may also involve fieldwork out of session. **(Old No. 27.951G/46.200G)**

GEOG9260 Medical Aspects **C2**

Aspects of medicine bearing upon physiological ! consequences of pollutants. Synergism and antagonisms, photosynthesis and phytotoxicity, metabolic mechanisms; morbidity and mortality surveys; exposure indices. Particular pollutants aldehydes, nitroolefins, carbon monoxide, sulphur dioxide, oxides of nitrogen, hydrocarbons, ozone and oxidants, particulates, carcinogens. **(Old No. 46.203G)**

GEOG9270 Legislative Aspects **C2**

Resources in law for the preservation of satisfactory environments. Local government, town planning, environmental, common law. History of Australian legislation consequences in border regions. Types of legislation and machinery measures and actions thereunder. Problems of administration of available law. American experience. Economic and sociological factors. **(Old No. 46.204G)**

School of
Materials Science and Engineering

School of Materials Science and Engineering

Head of School
Associate 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, electronics 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 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, mechanical testing. X-ray, optical and electron microscopy facilities.

Ceramic Engineering and Ceramics

The ceramic industry produces and 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 may 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 Department 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 two broad categories. Some go initially into activities associated directly with production, ie 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. In either case, graduates with organizing ability frequently move into managment if they have an interest in this side of the industry.

In Australia, a number of government research organizations are active in ceramic research, eg the Australian Nuclear Science and Technology Organisation, and the Divisions of Materials Science and Building Research of 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 and the Royal Australian Chemical Institute.

Metallurgical Engineering

The metallurgical profession has developed in importance in keeping with the growth of the 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 the opportunities for a career in management are excellent, since it is a tradition in this industry that management should be in the hand of technical people. If the 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 the 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.

These courses meet the formal educational requirements for admission to the professional institutes, such as 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 applied the principles of science and engineering to the design and development of metallic, ceramic and plastic materials and to their manufacture into goods and their subsequent performance in service. It is founded on the relationship between structure and properties an understanding of which permits materials to be engineered to specific end use requirements. Virtually every man-made material is now the subject of study of the Materials Engineer.

Due to an increasing demand for optimised materials, graduates in Materials Engineering are presented with an outstanding range of job opportunities. Many graduates pursue an industrial career either in the materials producing industries, the utilities or the 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, 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, Australasia.

Staff

School of Materials Science and Engineering

Associate Professor and Head of School
David John Young, BSc PhD *Melb.*, FRACI MAmerIChE, FIE Aust

M.M. Chair of Superconductivity
Shi Xue Dou, BSc PhD *Dalhousie*

Senior Lecturers
Sidney Blairs, BSc PhD *Manc.*, FIMMA
Alan Gordon Crosky, BSc PhD *N.S.W.*, MIMMA
Harald Herbertsson, BSc PhLic *Lund.*, PhD *Stockholm*
Peter Krauklis, BSc PhD *N.S.W.*, CPEng., MIMMA
Sviatoslav Antonovich Prokopovich, MSc *N.S.W.*, ASTC, CPEng, *MIEAust*

Charles Christopher Sorrell, BS *Missouri*, MS *Penn*, PhD *N.S.W.*
John Maurice Wheatley, MA PhD *Camb.*, CPEng, FIMMA, FAusWI, MWeld *Lond.*
David Ronald Young, BSCEng PhD *Lond.*, ARSM, AMAusIMM

Lecturers
Alan Keith Hellier, MA *Camb.*, PhD *N.S.W.*, AMIM, AMIMechE, MAus IMM

Honorary Visiting Professor
Max Hatherly, MSc PhD *N.S.W.*, ASTC, FTS, CPEng, FIM

Professional Officers
Frederick Henry Scott, BSc N.S.W., MAIP
John Walton Sharp, BScTech *N.S.W.*

Administrative Assistant
Ole Staer Andersen, Magr Copenhagen, MGenStud *N.S.W.*

Course Outlines

Undergraduate Study

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 BScTech degree, are offered within the School.

3025
Ceramic Engineering - Full-time Course

Bachelor of Engineering
BE

Year 1		Hours per week S1	S2
PHYS1002	Physics 1	6	6
CHEM1101	Chemistry 1A	6	0
CHEM1201	Chemistry 1B	0	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 Descriptive Geometry	4	0
MECH0440	Statistics	0	3
MATH1032	Mathematics 1	6	6
		24	24

Year 2			
CHEM2011	Physical Chemistry	6	0
CHEM2031	Inorganic Chemistry and Structure	0	6
MATS1032	Materials Engineering 1A	3.5	0
MATS1042	X-Ray Diffraction & Electron Microscopy	0	4
MATS1052	Materials Engineering 1B	0	3.5
MATS1062	Mechanical Prop 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	1.5	1.5
MPEM7341	Mineral Process Eng	2	0
MATH2021	Mathematics	2	2
	General Studies (Category A)	2	2
		24	24

Year 3			
FUEL0040	Fuel Engineering for Ceramic Engineers	1	1
MATS1113	Ceramic Process Principles 1	2	0
MATS2123	Ceramic Process Principles 2	0	2
MATS2133	Ceramic Raw Materials	2	0
MATS2143	Ceramic Equipment	0	3
MATS2153	Ceramic Processing Lab	3	3
MATS1163	Chemistry of the solid State	3	0
MATS2173	Chemistry of Ceramic Processing (Units 1 and 2)	2	2
MATS2203	Physico-Chemical Ceram Lab	3	4
MATS2193	Origins of Microstructure (Units 1 & 2)	4	0
MATS1093	Thermodynamics of Materials 2	2	0
MATH2819	Statistics SA	2	2
INDC3070	Instrument and Process Control	10	3
	General Studies (Category B)	0	4
		24	24

Year 4			
CEIC4010	Process Economics 1	1	0
CEIC4020	Process Economics 2	0	1
MATS1234	Management	0	2
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
MATS1294	Electrical Ceramics	0	3
MATS2304	Project (Ceramic Engineering)	6	6
MATS1464	Materials Seminar	2	2
MATS1224	Materials and Design 3 (Unit 1)	2	0
MATS1534	Design with Brittle Mater	3	0
INDC4070	Laboratory Automation Science	4	0
General Studies (Category C)		2	2
		24	22

3030
Ceramic Engineering - Part-time Course

Bachelor of Science Technology
BScTech

Stage 1		Hours per week S1	S2
PHYS1002	Physics 1	6	6
MATH1032	Mathematics	6	6
		12	12

Stage 2			
CHEM1101	Chemistry 1A	6	0
CHEM1201	Chemistry 1B	0	6

MATS1001	Introduction to Materials Industry	2	0
MATS1011	Introduction to Materials Engineering	0	1
MATS1021	Introduction to Computing	0	2
MECH0440	Statics	0	3
MECH0130	Engineering Drawing and Description Geometry	4	0
		12	12

Stage 3

CHEM2011	Physical Chemistry	6	0
CHEM2031	Inorganic Chemistry and Structure	0	6
MATS1072	Physics of Materials	3	0
MATS1082	Thermodynamics of Materials 1	0	3
MATH2021	Mathematics	2	2
	General Studies (Category A)	1	1
		12	12

Stage 4

		Hours per week S1	S2
MATS1032	Materials Engineering 1A	3.5	0
MATS1042	X-Ray Diffraction and Electron Microscopy	0	4
MATS1052	Materials Engineering 1B	0	3.5
MATS1062	Mechanical Properties of Materials	4	0
MATS1092	Materials and Design 1	0	2
MATS1102	Numerical Methods	1.5	1.5
MPEM7341	Mineral Process Engineering	2	0
	General Studies (Category A)	1	1
		12	12

Stage 5

MATS1113	Ceramic Process Principles 1	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
MATS1163	Chemistry of the Solid State	3	0
MATS1093	Thermodynamics of Materials 2	2	0
	General Studies (Category B)	0	4
		12	12

Stage 6

FUEL0040	Fuel Engineering for Ceramic Engineers	1	1
MATS2173	Chemistry of Ceramic Processes (Units 1 & 2)	2	2
MATS2193	Physico-Chemical Ceramics Laboratory	3	4
MATS2193	Origins of Microstructure (Units 1 & 2)	4	0
MATH2819	Statistics SA	2	2
INDC3070	Instrumentation and Process Control 1	0	3
		12	12

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

The School of Materials Science and Engineering introduced a "Process Metallurgy" option into its Metallurgical Engineering degree program, starting in 1990. This option is designed to produce graduates with training appropriate to the primary metallurgy industry. It has been established in response to a request from the BHP Company to provide metallurgical education to personnel from all of its steelmaking centres. Students will complete the first one or two years of their degree at their local university engineering school, and then transfer with advanced standing to UNSW. Before selecting UNSW, The BHP Company examined metallurgy programs at all Australian institutions.

It is intended that this program will serve the entire primary metallurgy industry. The aluminium industry has indicated its support by offering scholarships to attract additional students into the degree program.

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 Ceramics Engineering Courses and Materials Engineering. 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. The course has recently been revised. Students may now elect to major in either Process Metallury or Physical Metallurgy.

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 Years 2, 3 and 4 of the course, visits are made to various metallurgical works, and students are required to submit reports on some of these.

Year 1

		Hours per week S1	S2
PHYS1002	Physics 1	6	6
CHEM1101	Chemistry 1A	6	0
CHEM1201	Chemistry 1B	0	6
MATS1001	Introduction to Materials Industry	2	0
MATS1011	Introduction to Materials Engineering	0	1
MATS1021	Introduction to Computing	0	2
MECH0440	Statistics	0	3
ATS1001	Engineering Drawing and Descriptive Geometry	4	0
MATH1032	Mathematics 1	6	6
		24	24

Year 2

CHEM2011	Physical Chemistry	6	0
CHEM2031	Inorganic Chemistry and Structure	0	6
MATS1032	Materials Engineering 1A	3.5	0
MATS1042	X-Ray Diffraction and Electron Microscopy	0	4
MATS1052	Materials Engineering 1B	0	3.5
MATS1062	Mechanical Properties of Materials	4	0
MATS1072	Physics of Materials	3	0
MATS1082	Thermodynamics of Materials 1	0	2
MATS1092	Materials and Design 1	0	3
MATS1102	Numerical Methods	1.5	1.5
MPEM7341	Mineral Process Engineering	2	0
MATH2021	Mathematics	2	2
	General Studies Category A	2	2
		24	24

Year 3 (Physical Metallurgy Major)

MATS4363	Origins of Microstructure	7	3
MATS1203	Materials and Design 2	2	2
MATS4223	Mechanical Behaviour of Materials (Units 1-4 & 6,7)	4	7
MATS1043	Heat, Fluid and Mass Flow in MaterialsProcessing	3	0
MATS4053	Metallugraphic Techniques	2	0
MATS1253	Ferrous Alloys	0	3
MATS1263	Alloy Steels	0	2
MATS1083	Non-Ferrous Alloys	0	3
MATS1093	Thermodynamics of Materials 2	2	0
MATH2819	Statistics SA	2	2
	General Studies (Category B)	2	2
		24	24

Year 4 (Physical Metallurgy Major)

		Hours per week S1	S2
MATS4104	Metallurgy Project	6	6
MATS4114	Professional Electives	6	4
MATS1464	Materials Seminar	2	2
MATS4134	Stucture and Properties of Metallurgy Phases	0	3
MATS4144	Mechanical and Thermal Processing of Materials	3	0
MATS1154	Advanced Materials	3	0
MATS3484	Welding Science and Technology (Unit 1)	0	1
MATS4324	Materials and Design 3	4	2
APSC0002	Social Issues in the Applied Sciences	2	0
	General Studies (Category C)	0	2
		26	20

Year 3 (Process Metallurgy Major)

		S1	S2
MATS1173	Chemistry of Ceramic Processes (Unit 1 Refractories)	2	0
MATS5203	Origins of Microstructure (Unit 1 Phase Equilibria)	2	0
MATS1203	Materials and Design 2	2	2
MATS5223	Mechanical Behaviour of Materials (Unit 4 Metal Forming Processes)	2	0
MATS5213	Metallurgical Plant Practice (Part)	0	2
MATS1043	Heat, Fluid and Mass Flow in Materials Processing	3	0
MATS4053	Metallographic Techniques	2	0
MATS1253	Ferrous Alloys	0	3
MATS1263	Alloys Steels	0	2
MATS1083	Non-ferrous Alloys	0	3
MATS1093	Thermodynamics of Materials 2	2	0
MATS5253	Metallurgical Reaction Engineering	2	2
MATS5263	Extractive Metallurgy 1	2	5
INDC3070	Instrumentation & Process Control 1	0	3
FUEL3010	Fuel Engineering 1 (Units 2 to 4)	1	2
	General Studies (Category B)	4	0
		24	24

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Year 4 (Process Metallurgy Major)

		S1	S2
MATS1234	Management	0	2
MATS4104	Metallurgical Project	6	6
MATS5314	Kinetics and Mass Transfer in Metallurgical Processes	3	1
MATS5324	Modelling of Metallurgical Processes	0	4
MATS5334	Professional Electives	5	5
MATS5224	Mechanical Behaviour of Materials (Units 6 Quality Assur & Ctrl)	0	1
MATS1464	Materials Seminar	2	2
MATS1154	Advanced Materials	3	0
MATS1164	Welding Sci and Technology	0	3
MATS5384	Air Pollution Control in the Metallurgical Industry	1	0
APSC0002	Social Issues in the Applied Sciences	2	0
	General Studies (Category C)	2	0
		24	24

3130
Metallurgy - Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

This course is designed for students who are employed in the metallurgical and manufacturing industries and extends over six part-time years of study. Some of the subjects of stages 3, 4, 5 and 6 may be available only in day-time classes, and up to one days 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 metallurgy 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.

Stage 1		**Hours per week** S1	S2
PHYS1002	Physics 1	6	6
MATH1032	Mathematics 1	6	6
		12	12
Stage 2			
CHEM1101	Chemistry 1A	6	0
CHEM1201	Chemistry 1B	0	6
MATS1001	Introduction to Materials Industry	2	0
MATS1011	Introduction to Materials Engineering	0	1
MATS1021	Introduction to Computing	0	2
MECH0440	Statics	0	3
MECH0130	Engineering Drawing and Description Geometry	4	0
		12	12

Stage 3		**Hours per week** S1	S2
CHEM2011	Physical Chemistry	6	0
CHEM2031	Inorganic Chemistry and Structure	0	6
MATS1072	Physics of Materials	3	0
MATS1082	Thermodynamics of Materials 1	0	3
MATH2021	Mathematics	2	2
	General Studies (Category A)	1	1
		12	12

Stage 4

MATS1032	Materials Engineering 1A	3.5	0
MATS1042	X-Ray Diffraction and Electron Microscopy	0	4
MATS1052	Materials Engineering 1B	0	3.5
MATS1062	Mechanical Properties of Materials	4	0
MATS1092	Materials and Design 1	0	2
MATS1102	Numerical Methods	1.5	1.5
MPEM7341	Mineral Process Engineering	2	0
	General Studies (Category A)	1	1
		12	12

Stage 5

MATS4463	Origins of Microstructure (Units 1-3)	7	0
MATS7223	Mechanical Behaviour of Materials (Units 1-3 & 4A)	3	4
MATS4053	Metallographic Techniques	2	0
MATS1253	Ferrous Alloys	0	3
MATS1083	Non-Ferrous Alloys	0	3
	General Studies (Category B)	0	2
		12	12

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	3	0
MATS1263	Alloy Steels	0	2
MATS1164	Welding Science and Technology	0	3
MATS4204	Industrial Metallurgy Project	3	3
	General Studies (Category B)	2	0
		12	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

Year 1		**Hours per week** S1	S2
PHYS1002	Physics 1	6	6
CHEM1101	Chemistry 1A	6	0

CHEM1201	Chemistry 1B	0	6
MATS1001	Introduction to the Materials Industry	2	0
MATS1011	Introduction to Materials Engineering	0	1
MATS1021	Introduction to Computing	0	2
MECH0440	Statics	0	3
MECH0130	Engineering Drawing and Descriptive Geometry	4	0
MATH1032	Mathematics 1	6	6
		24	24

Year 2

		S1	S2
CHEM2011	Physical Chemistry	6	0
CHEM2031	Inorganic Chemistry and Structure	0	6
MATS.1032	Materials Engineering 1A	3.5	0
MATS1042	X-Ray Diffraction and Electron Microscopy	0	4
MATS1052	Materials Engineering 1B	0	3.5
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	1.5	1.5
MPEM7341	Mineral Process Engineering	2	0
MATH2021	Mathematics	2	2
	General Studies (Category A)	2	2
		24	24

Year 3

		S1	S2
CEIC4010	Process Economics 1	1	0
MATS1113	Ceramic Process Principles 1	2	0
MATS1163	Chemistry of the Solid State	3	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	0	3
MATS1093	Thermodynamics of Materials 2	2	0
MATH2819	Statistics SA	2	2
MATS3443	Polymer Science and Engineering	0	6
	General Studies (Category B)	0	4
		23	23

Year 4

		S1	S2
MATS1294	Electrical Ceramics	0	3
MATS1464	Materials Seminar	2	2
MATS1263	Alloy Steels	0	2
MATS3484	Welding Science and Technology (Unit 1)	0	1
MATS1083	Non-Ferrous Alloys	0	3
MATS3324	Materials and Design 3 (Units 1 & 2)	4	0
MATS3524	Materials Engineering Project	6	6
MATS1534	Design with Brittle Materials	3	0
MATS3544	Polymer Engineering	3	3
MATS3554	Professional Electives	4	2
	General Studies (Category C)	2	2
		24	24

Graduate Study

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, Master of Engineering or Doctor of Philosophy in metallurgy or ceramic engineering or who are intereted in programs involving formal course work and research leading to the award of Graduate Diploma in Materials.

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.

5035
Graduate Diploma in Materials

Graduate Diploma
GradDip

The course is designed to provide specialist professional training in Materials at an advanced level for graduates in related courses in Science, Applied Science or Engineering and is aimed at extending the primary disciplines in this regard.

The current emphasis is on metallic and ceramic materials but it is anticipated that other specializations may be offered. Subject to consultation, other subjects may be drawn from graduate subjects available from other Schools by approval from the Heads of both Schools.

Entry Qualifications

Applicants for admission to the course must be graduates of this University or other approved university or have other qualifications deemed appropriate by the university. However, Faculty may require an applicant to take such other prerequisite or concurrent studies and or examinations as it may prescribe. It is expected that the first degree or other qualification contain mathematics, physics and chemistry to an acceptable level but students without these qualifications may be admitted subject to the approval of the Head of School or required to undertake a qualifying program.

In cases in which qualifying programs or bridging courses are required these can be designed to suit the needs of the individual candidates.

Course Requirements

Candidates are required to complete a program of formal study (including a Project) totalling 20 hours per week over two sessions on a full-time basis, or 10 hours per week over four sessions on a part-time basis. The full-time program will comprise a minimum of 12 hours per week drawn from the graduate subjects as listed below.

Students are assessed by written examination in graduate subjects and professional electives. Marks are assigned to each component of the course according to the proportion of time spent in each graduate subject and professional elective.

The subjects in the graduate program shall comply with the following compulsory and elective subjects in which the professional electives are drawn from the undergraduate group of subjects comprising subject MATS4114 Professional Electives with extensions as appropriate to the graduate level.

Compulsory Subjects

		Hours per week S1	S2
MATS6395	Professional Electives	5	5
MATS6405	Graduate Seminar	2	2
MATS6415	Graduate Materials Project	6	6
MATS6425	Metallurgical Engineering 2C	3.5	3.5
		16.5	16.5

Elective Graduate Subjects*

Plus not less than 4 hours per week of electives drawn from the following subjects:

MATS6435	Metallurgical Practice		
MATS6445	Advanced Metallurgical Techniques		
MATS6455	Advanced Theoretical Metallurgy		
MATS6465	Advanced Materials Technology	4	4
		20.5	20.5

*The program selected by each student must be approved by the Head of School. Not all electives are offered each session, nor is the full range available each year. Subject to consultation other graduate subjects may be drawn from other Schools by approval from the Heads of both Schools.

Subject Descriptions

Undergraduate Study

MATS1001 Introduction to the Materials Industry **S1 L1 T1**

The roll 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. **(Old No. 4.501)**

MATS1011 Introduction to Materials Engineering **S2 L1**

Metals, ceramics, polymers and composites, their structure, chemical, physical and mechanical properties, engineering applications and production with particular reference to Australian industries. **(Old No. 4.511)**

MATS1021 Introduction to Computing **S2L2**

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. **(Old No. 4.521)**

MATS1032 Materials Engineering 1A **S2L1 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 and metallurgical engineering practice in the broadest sense. **(Old No. 4.712)**

MATS1042 X-Ray Diffraction and Electron Microscopy **S1 L2 T2**

Prerequisite: 4.412A or 4.212

X-ray diffraction, electron optics, and analysis. Production, absorption and diffraction of X-rays. Powder and single crystal X-ray methods. Stereographic projections and crystal geometry. Applications of diffraction methods to solid solutions and solubility limit, thermal analysis, stress measurement, chemical analysis. X-ray fluourescence spectroscopy and analysis, on-stream analysis. Electron optics and analysis, transmission and scanning electron microscopy. Energy-loss spectrometers, microanalysis. **(Old No. 4.713)**

MATS1043 heat, Fluid and Mass Flow in Materials Processing **S1L2 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. **(Old No. 4.533)**

MATS1052 Materials Engineering 1B **S2 L1 Tl.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 temperaturesolid, liquid and gaseous phases. Thermal properties of dense and porous materials. Heat treatment, casting, calculation, sintering, corrosion, etc.. Computer programs for calculating heat flow in materials. **(Old No. 4.722)**

MATS1062 Mechanical Properties of Materials **S1 L2 T2**

Prerequisite: 5.0011. Co-requisite: 4.412A.

Mechanical properties of solids. Nature and significance of mechanical properties. Mechanical testing; the tension test, hardness testing and impact testing. Stress-strain-time relationships. Analysis of stress and strain, stress and strain transformation relationships, Mohr's circle, elastic stress-strain relationships, application to various types of loading and metal working processes. Failure and yeilding criteria. Influence of stress state, temperature, strain rate and environment on mechanical behaviour. **(Old No. 4.732)**

MATS1072 Physics of Materials **S2 L2 T1**

Pre-requisite: 1.001 or 1.011.

Interatomic bonding in solid materials. Types of interatomic bonds, metallic, covalent, ionic. Introductory quantum mechanics in one dimension, free electron theory, effects of periodic potential, density of states curves. Effect of electron to atom ratio on conductivity and crystal structure; semiconductors; instrinsic, extrinstic. Exchange energy; ferromagnetism, antiferromagnetism. Elementary perturbation theory, covalent bond; crystal structures, properties. Ionic bond, crystal structures, force models, properties. **(Old No. 4.742)**

MATS1082 Thermodynamics of Materials 1 **S2L2 T1**

Fundamental principles of the thermodynamics of closed and open systems. Phase equilibria, the stability and composition of coexisting phases. Chemical potential, fugasities 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. **(Old No. 4.752)**

MATS1083 Non-ferrous Alloys **S2L1 T2**

Metallography of non-ferrous alloys. Structure/property relationships in non-ferrous alloys. Hardening mechanisms. Metallography and properties of copper, aluminium, nickel,

magnesium, lead, tin and titanium based alloys. **(Old No. 4.573)**

MATS1092 Materials and Design 1 **S2L1 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. **(Old No. 4.762)**

MATS1093 Thermodynamics of Materials 2 **S1L2**

Thermodynamic functions of mixing, excess and integral mixing functions. Thermodynamics stability and models of solutions. Long-range order in solutions. Calculation of phase diagrams. Thermodynamics of non-stoichemetric phases. Thermodynamics of surfaces and interfaces, influence of curvature, adsorption and segregation, surface energies. Thermodynamics of polymer solutions. Equilibria in complex systems, surface treatments, materials preparation. Computer programs for materials preparation, reactivity and industrial applications. **(Old No. 4.583)**

MATS1102 Numerical Methods **FL1 T.5**

Finite difference and finite element techniques and their application to materials phenomena involving diffusional transport, elasticity and plasticity. **(Old No. 4.823)**

MATS1113 Ceramic Process Principles 1 **S1L2**

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. **(Old No. 4.203)**

MATS1154 Advanced Materials

Unit 1 Magnetic Materials **S1 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 **S1L1**

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 **S1L.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 **S1L.5**

Classification of titanium alloys. Commercial alloys, aerospace and corrosion resistant alloys. Heat treatment, strengthening mechanisms, superplastic forming, forging, powder metallurgy. **(Old No. 4.554)**

MATS1163 Chemistry of the Solid State **S1 L3**

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, and ceramic reactions (oxides, non-oxides, aluminosilicates). **(Old No. 4.253)**

MATS1164 Welding Science and Technology

Unit 1 Welding Technology **S1 or S2 L1**

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

Unit 2 Welding Metallurgy **S1 or S2 L1 T1**

Metallurgical aspects of fusion welding and allied processed. Caused 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. **(Old No. 4.564)**

MATS1173 Chemistry of Ceramic Processes

Unit 1 Refractories **S1 L2**

Classification of refractories. Chemical and physical properties of refractories. Introduction to raw materials and manufacturing technology. A detailed study of chemical reaction s occurring between refractories and solid, liquid and gas phases in ferrous and non-ferrous metal industry. Review of phase equilibria. **(Old No. 4.263)**

MATS1203 Materials and Design 2

Unit 1 Design for corrosion control **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 **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. **(Old No. 4.513)**

MATS1234 Management **S2 L2**

The major issues, research findings and management strategies relating to the human side of enterprise. Topics include management and power, leadership and innovation, managerial decision-making, stress at work, group dynamics and inter-group conflict, organisational design, goal setting and performance appraisal, approaches to personal and organisational development. **(Old No. 4.064)**

MATS1253 Ferrous Alloys **S1 L1 T2**

Ferrous alloys. Iron-carbon Phase equilibrium diagrams. Microstructure and properties of plain carbon steels. Austenite decomposition under equilibrium and non-equilibrium conditions. Dilatometry. Heat treatment of steels. Surface hardening treatment. Microstructure and properties of ordinary cast irons, including grey, white, mottled, malleable and ductile irons. **(Old No. 4.553)**

MATS1263 Alloy Steels **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. **(Old No. 4.563)**

MATS1294 Electrical Ceramics **S2 L1T2**

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. **(Old No. 4.254)**

MATS1464 Materials Seminar **F T2**

Lectures on the preparation and presentation of technical papers. Development of encoding and decoding communication skills in the various communication media. Chairpersonship.

Professional ethics and etiquette. Organisation and direction of conferences. Traditional and on-line retrieval of information. Each student is required to prepare and present a paper on their Metallurgy, Ceramic Engineering or Materials Engineering or Materials Engineering project. **(Old No. 4.524)**

MATS1534 Design with Brittle Materials **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 non-destructive testing. **(Old No. 4.704)**

MATS2123 Ceramic Process Principles 2 **S2 L2**

Plasticity in a clay - water system. Linear drying shrinkage. Air - water vapour system, psychrometry and drying calculations. Mechanism of polymorphic transformations. 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. **(Old No. 4.213)**

MATS2133 Ceramic Raw Materials **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. **(Old No. 4.223)**

MATS2143 Ceramic Equipment **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 auxillary processing operations; forming, drying and firing of ceramic products. **(Old No. 4.233)**

MATS2153 Ceramic Processing Laboratory **F T3**

Laboratory programme illustrating processing and engineering aspects of ceramic technology. Students are required to take part in a series of factory inspections. **(Old No. 4.243)**

MATS2173 Chemistry of Ceramic Processes

Unit 1 Refractories **S1 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 phase in ferrous and non-ferrous metal industry. Review of phase equilibria.

Unit 2 Technical and Non-Technical Ceramics **S2 L2**

High-temperature reactions involving clays, silicates, oxides, and non-oxides. Processing effects of calcining, chemical reaction, and vitreous and crystalline bond formation. Chemical and physical aspects of production of whitewares, porcelain, refractories, heavy clay products, glass, cements, cermets, and advanced high-purity ceramics. **(Old No. 4.263)**

MATS2193 Origins of Microstructures

Unit 1 Phase equilibria **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 **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. **(Old No. 4.503)**

MATS2203 Physico-Chemical Ceramics Laboratory **S1T3 S2T4**

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. **(Old No. 4.273)**

MATS2244 Ceramic Process Engineering S1 L2

Advanced treatment of fluid flow and heat transfer: non-Newtonian fluids and unsteady state heat transfer. Flow through porous media. A detailed study of ceramic forming methods. **(Old No. 4.204)**

MATS2254 Ceramic Engineering Design S2 L2

Engineering aspects of ceramic processing. Ceramic engineering design including design of dryers, kilns and glass tanks. Case studies. Pollution control equipment. **(Old No. 4.214)**

MATS2264 Sintering of Ceramics S1 L1.5 T.5

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. **(Old No. 4.224)**

MATS2274 Mechanical Properties of Ceramics 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). **(Old No. 4.234)**

MATS2284 Thermal Properties of Ceramics 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. Influence of structure and composition of pure materials on thermal conductivity of multiphase ceramics. **(Old No. 4.244)**

MATS2304 Project (Ceramic Engineering) F T6

An experimental or technical investigation or design related to some aspects of ceramic engineering. **(Old No. 4.264)**

MATS3443 Polymer Science and Engineering 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. **(Old No. 4.593)**

MATS3484 Welding Science and Technology S1 or S2 L1

Unit 1 Welding Technology S1 or S2 L1

Fusion welding and allied processes. Capabilities, advantages and limitations. **(Old No. 4.564)**

MATS3524 Materials Engineering Project F6

An experimental or technical investigation or design related to some aspects of materials engineering. **(Old No. 4.594)**

MATS3544 Polymer Engineering 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. Time-temperature superposition. Fatigue. Selection of commodity plastics, engineering plastics and elastomers for particular applications. Adhesives. Mechanisms of adhesion. Coatings. Properties and performance requirements of coatings. Degredation. Weathering, thermal resistance, radiation resistance and resistance to other environments. **(Old No. 4.5124)**

MATS3554 Professional Electives (Materials Engineering) S1 4 S2 2

A combination of elective subjects totalling 84 hours in the year. **(Old No. 4.044)**

MATS4053 Metallographic Techniques S1 L1 T1

Metallographic techniques. Principles of optical microscopy. Quantitative microscopy and stereology. **(Old No. 4.543)**

MATS4104 Metallurgy Project/Metallurgical Engineering Project F6

An experimental investigation of some aspects of metallurgy or metallurgical engineering. **(Old No. 4.504)**

MATS4114 Professional Electives (Physical Metallurgy) S1 6 S2 4

A combination of elective subjects totalling 140 hours in the year. **(Old No. 4.044)**

MATS4134 Structure and Properties of Metallurgical Phases

Unit 1 Structure and Properties of Solids S2 L1 T1

Application of the chemistry of the defect solid state to materials preparation and reactivity. Non-stoichiometric and stoichiometric-dependent physical and chemical properties of metal compounds.

Unit 2 Structure and Properties of Melts 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. **(Old No. 4.534)**

MATS4144 Mechanical and Thermal Processing of Materials **S1 or S2 L3**

Unit 1 Deformation and forming of sheet metal **S1 or S2 L2**

Mechanisms of deformation. Origin of rolling and annealing textures. Inhyomogeneities 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. **(Old No. 4.544)**

MATS4223 Mechanical Behaviour of Materials (Units 1,2,3 & 4)

Unit 1 Deformation **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 **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 **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 **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. **(Old No. 4.523)**

MATS4363 Origins of Microstructures (Units 1,2,3,4)

Unit 1 Phase equilibria **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 crystallisation; cooling curves, crystallisation paths.

Unit 2 Diffusion **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 **S1 T3**

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

Unit 4 Phase transformations **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. **(Old No. 4.503)**

MATS4463 Origin of Microstructures Double Degree (Units 1,2,3)

Unit 1 Phase equilibria **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 crystallisation; cooling curves, crystallisation paths.

Unit 2 Diffusion **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 **S1 T3**

Determination of equilibrium phase diagrams. Solidification processes in moulds. Metallography of non-ferrous alloys. **(Old No. 4.503)**

MATS5203 Origin of Microstructures (Unit 1)

Unit 1 Phase equilibria **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 crystallisation; cooling curves, crystallisation paths. **(Old No. 4.503)**

MATS5213 Metallurgical Plant Practice **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. **(Old No. 4.5164)**

MATS5223 Mechanical Behaviour of Materials (Unit 4 only)

Unit 4 Metal forming processes 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 only)

Unit 6 Quality assurance and control 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.

MATS5314 Kinetics and Mass Transfer in Metallurgical Processes S1 L2T1 S2L1

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 inter faces. Application to metal refining process. Vacuum degassing and refining processes. **(Old No. 4.5104)**

MATS5324 Modelling Metallurgical Processes S2 L3

The mathematical and physical modelling of primary and secondary metals processing operations. Ladle metallurgy operations, entrainment of gases by molten metals, electromagnetically driven flows, dispersion of alloying additions, coalescance of inclusions, modelling metal flow and solidification, blast furnace drainage, mathematical plasticity, estimation of stresses developed during industrial deformation processes, rolling, drawing, bending. **(Old No. 4.5114)**

MATS5334 Professional Electives (Process Metallurgy) S1 5S2 5

A combination of elective subjects totalling 140 hours in the year. **(Old No. 4.044)**

MATS5384 Air Pollution Control in the Metallurgical Industry S1 or S2 L.5 T.5

Case studies of emission survey, measurements and compliance program planning in the primary and secondary metallurgical industries. **(Old No. 4.694)**

MATS6425 Metallurgical Engineering 2C F L2 T1

Prerequisites: 10.001 or 10.011.

Mathematical methods. 1. 10.301 Statistics SA see Engineering Handbook 2. Numerical methods. Finite difference and finite element techniques and their application to metallurgical phenomena involving diffusional transport, elasticity and plasticity. **(Old No. 4.633)**

MATS7134 Structure and Properties of Metallurgical Phases

Unit 1 Structure and Properties of Solids S2 L1 T1

Application of the chemistry of the defect solid state to materials preparation and reactivity. Non-stoichiometric and stoichiometric-dependent physical and chemical properties of metal compounds.

Unit 2 Structure and Properties of Melts 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. **(Old No. 4.534)**

MATS7144 Mechanical and Thermal Processing of Materials S1 or S2 L3

Unit 1 Deformation and forming of sheet metal S1 or S2 L2

Mechanisms of deformation. Origin of rolling and annealing texture. Inhomogeneities of deformation. Texture control and controlled rolling. Application to transformer steel, HLSA 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.

T1

Unit 2 Powder Metallurgy S1 or S2 L1

Mechanisms of sintering in metals. Techniques of powder metallurgy; compaction, powder characteristics. Sintering in presence of liquid phase, cementation, cermets. Preparation of super-alloys. **(Old No. 4.544)**

MATS7154 Advanced Materials

Unit 1 Magnetic Materials S1 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 S1 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 S1 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 S1 L.5

Classification of titanium alloys. Commercial alloys, aerospace and corrosion resistant alloys. Heat treatment, strengthening mechanisms, superplastic forming, forging, powder metallurgy. **(Old No. 4.554)**

MATS7164 Welding Science and Technology S1 or S2 L2 T1

Unit 1 Welding Technology S1 or S2 L1

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

Unit 2 Welding Metallurgy

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. **(Old No. 4.564)**

MATS7223 Mechanical Behaviour of Materials (Units 1-3 & 4A)

Unit 1 Deformation 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 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 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 4A (Part of) Metal forming processes 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.

MATS7234 Management S2 L2

The major issues, research findings and management strategies relating to the human side of enterprise. Topis include management and power, leadership and innovation, managerial decision-making, stress at work, group dynamics and inter-group conflict, organisational design, goal setting and performance appraisal, approaches to personal and organisational development. **(Old No. 4.064)**

MATS7244 Advanced Electron Optics S1 or S2 L1 T1

See School for details.

MATS7264 Sintering of Ceramics S1 L1.5 T.5

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. **(Old No. 4.224)**

MATS7274 Mechanical Properties of Ceramics S2 L2

Elasticity and anelasticity, submicroscopic flaw theory, nucleation and formation of cracks, 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). **(Old No.4.234)**

MATS7284 Thermal Properties of Ceramics 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. Influence of structure and composition of pure materials on thermal conductivity of multiphase ceramics. **(Old No. 4.244)**

MATS7384 Air Pollution Control in the Metallurgical Industry S1 or S2 L.5 T.5

Case studies of emission survey, measurements and compliance program planning in the primary and secondary metallurgical industries. **(Old No. 4.694)**

MATS7470 Polymer Processing and Fabrication 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. **(Old No. 4.5134)**

MATS7480 Polymer Product Design 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. **(Old No. 4.5144)**

MATS7490 High Temperature Techniques S1 or S2 L1

Experimental methods for the determination of thermophysical and thermochemical properties at elevated temperatures. **(Old No. 4.494)**

MATS7500 Mathematical Plasticity 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. **(Old No. 4.674)**

MATS7534 Design with Brittle Materials 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 non-destructive testing. **(Old No. 4.704)**

MATS8193 Origins of Microstructures

Unit 1 Phase equilibria 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 crystallisation; cooling curves, crystallisation paths.

Unit 2 Diffusion 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 S1 T3

Determination of equilibrium phase diagrams. Solidification processes in moulds. Metallography of non-ferrous alloys. **(Old No. 4.503)**

MATS9130 Materials Science F L2 T1

1. The properties of crystalline solids. Defect structure of crystals. Influence of defects on the behaviour of crystals. The properties of metals and metallic alloys in terms of modern theories. The development of alloys for specific engineering applications. The elastic and plastic properties of solids. The mechanisms of fracture in crystalline solids. Ductile and brittle fracture. Creep. Fatigue. Design of materials. **2.** *Metallic corrosion. Polymer materials:* The structure and properties of polymers. Mechanisms for the modification of properties. *Ceramic materials:* The structure and properties of ceramics. Similarities and differences with other crystalline solids. Ceramic-metal composites. **(Old No. 4.913)**

MATS9193 Origin of Microstructure

Unit 2 Diffusion S1 L1 T1

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

Unit 4 Phase transformations 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. **(Old No. 4.503)**

MATS9223 Mechanical Behaviour of Materials (Units 1,2,3,7)

Unit 1 Deformation S1 L2

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

Unit 2 Fractographic analysis 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 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 S2 L.5 T1.5

Extension of fractographic analysis to include creep, hydrogen embrittlement and corrosion fatigue. Analysis of service failures using metallographic and fractographic techniques. **(Old No. 4.523)**

MATS9323 Mechanical Behaviour of Materials (Units 1,2,3)

Unit 1 Deformation 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 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 **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. **(Old No. 4.523)**

MATS9340 Design with Advanced Materials **S2 L4 T2**

The development, application and design with advanced materials of relevance to the chemical process industries. Studies of case histories of engineering service failures. **(Old No. 4.934)**

MATS9420 Materials for Mining Engineers **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. **(Old No. 4.942)**

MATS9520 Engineering Materials **L2 L/T1**

Microstructure and structure-property relationships of the main types of engineering materials (Metals, Ceramics, Polymers and Composites). Micromechanisms of elastic and plastic deformation. Fracture mechanisms for ductile, brittle, creep and fatigue modes of failure in service; corrosion. Metal forming by casting and wrought processes. Phase Equilibria of alloys; microstructural control by thermomechanical processing and application to commerical engineering materials. Laboratory and tutorial work includes experiments on cast and recrystallised structures, ferrous and non-ferrous microstructures and fracture and failure analysis.

MATS9640 Materials Science and Engineering for Electrical Engineers **S2 L3 T1**

Prerequisite: 1.982 Solid State Physics.

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. **(Old No. 4.964)**

Graduate Study

For Information Key refer to page 10.

MATS6405 Graduate Materials Seminar **F L1 T1**

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. **(Old No. 4.201G)**

MATS6415 Graduate Materials Project **F6**

An experimental, technical investigation or design project, including a written thesis. **(Old No. 4.241G)**

MATS6435 Metallurgical Practice **S1 or S2**

Studies relating to one or more specialised areas such as founding, welding, corrosion. **(Old No. 4.211G)**

MATS6445 Advanced Metallurgical Techniques **S1 or S2**

Lectures and laboratory work in such areas as metallography, electron microscopy, stress analysis, fracture mechanics, mechanical testing and electrochemical techniques. **(Old No. 4.221G)**

MATS6455 Advanced Theoretical Metallurgy **S1 or S2**

Topics drawn from physical, chemical and mechanical metallurgy. **(Old No. 4.231G)**

MATS6465 Advanced Materials Technology **S1 or S2**

Principles of materials selection, selection of materials based on engineering design criteria, materials, specifications and principles and methods of non-destructive testing. **(Old No. 4.251G)**

School of Mines

School of Mines

Head of School
Professor F. F. Roxborough

The School of Mines, which was formed in 1986, consists of two Departments and an Institute corresponding to the three main professions on which the mining and minerals industry of Australia depends. These are the Departments of Applied Geology and Mining Engineering, and the Institute for Minerals Engineering (in conjunction with the School of Chemical Engineering).

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 G. R. Taylor

Geology is 'the science of the earth', and as such covers a broad spectrum of knowledge on the constitution and evolution of our planet. Applied geology involves a specific interest in the use of earth science for the benefit of humanity, including, for example, the search for and evaluation of metallic ore-bodies and accumulations of fossil fuels, or the application of geological knowledge to a range of engineering and environmental problems.

Department of Mining Engineering

Head of Department
Associate Professor E. G. Thomas

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.

Institute for Minerals Engineering

Director

Professor M. S. Wainwright

Students wishing to specialize 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

Staff

School of Mines

Professor of Mining Engineering and Head of School
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Department of Applied Geology

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Department of Mining Engineering

Associate Professor and Head of Department of Mining Engineering
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Institute for Minerals Engineering

Director
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Key Centre for Mines (Incorporates the University of New South Wales and the University of Wollongong)

Director
Vacant

Associate Director - International
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Robyn Stutchbury, BSc *Macq.*

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Centre for Groundwater Management and Hydrogeology

In association with the Faculty of Engineering

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Professional Officers
Robert Gregor McLaughlan, BSc DipMAppSc *N.S.W.*

Administrative Assistant
Areerom Romy Peters

Course Outlines

Undergraduate Study

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.

Through lectures, laboratory work, projects and field tutorials students learn the fundamental principles of geology. 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 that have not undertakent Physics or Chemistry at HSC level are advised to take those subjects 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 Faculty of Science, Board of 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

Year 1		**Hours per week** S1	S2
PHYS1002	Physics 1	6	6
or			
PHYS1022	Introductory Physics	6	6
CHEM1101	Chemistry 1A	6	0
and			
CHEM1201	Chemistry 1B or	0	6
CHEM1401	Introductory Chemistry A	6	0
and			
CHEM1501	Introductory Chemistry B	0	6
MATH1032	Mathematics 1 *or*		
MATH1011	General Mathematics 1B *and*	6	0
MATH1021	General Mathematics 1C	0	6
GEOL1101	Geological Processes**	6	0
GEOL1201	Geological Environments**	0	6
		24	24

**Up to 2 days of field tutorials in GEOL1101 Geological Processes and up to 4 days in GEOL1201, Geological Environments are essential parts of these subjects. Attendance is compulsory.

Year 2			
GEOL2111	Earth Materials 1**	6	0
GEOL2121	Earth Environments 1**	6	0
GEOL2211	Earth Materials 2***	0	6
GEOL2231	Earth Physics*	0	6
GEOL2230	Mathematical Geology 1	0	3
	General Education Elective	2	2
		14	17

*Field work of up to 2 days is a compulsory part of the subject.
**Field work of up to 5 days is a compulsory part of the subject.
***Field work of up to 4 days is a compulsory part of the subject.

Students take Ancillary Subjects equivalent to 2 units from Table 1 of the Combined Sciences Handbook.

Year 3			
GEOL3111	Earth Materials 3	6	0
GEOL3211	Earth Materials 4*	0	6
GEOL3121	Earth Environments 2**	6	0
GEOL3331	Exploration Geophysics	3	2
GEOL3130	Mathematical Geology 2	3	0
GEOL3141	Mineral and Energy Resources 1***	6	0
GEOL3241	Mineral and Energy Resources 2*	0	6
GEOL3251	Engineering and Environmental Geology***	0	6
GEOL3281	Exploration Geochemistry	0	2
GEOL3271	Structural Geology*	0	2
	General Education Elective	2	2
		26	26

*Field work of up to 4 days is a compulsory part of the subject.
**Field work of up to 7 days is a compulsory part of the subject.
***Field work of up to 3 days is a compulsory part of the subject.

Year 4			
GEOL4111	Advanced Geological Techniques*	6	0
GEOL4121	Professional Practice**	6	0
GEOL4131	Special Topics in Applied Geology**	12	0
GEOL4203	Field Project		24
		24	24

* Field work of up to 7 days is a compulsory part of this subject.
** Formal classes are scheduled for 13 weeks only to accommodate the field tutorial component of GEOL4111.

Recommended Programs in subject GEOL4131 Special Topics in Applied Geology:

		Hours per week (13 weeks)
a)	**Mineral Exploration and Mining Geology'**	
	Principles of Mining *or*	
	Mines Development	2
	Mine Economics	4
	Mineral Process Engineering or	
	Sampling and Analytical Methods	2
	Exploration Geology	2
		10
b)	**Sedimentary Basin Studies**	
	Seismic Stratigraphy	2
	Advanced Sedimentology	4
	Advanced Coal Geology	2
	Advanced Petroleum Geology	2
		10
c)	**Geophysics*'**	
	Gravity and Magnetic Methods	2
	Seismic Methods	2
	Electrical Interpretation	2
	Regional Geophysics	2
	Geophysical Interpretation	2
		10
d)	**Engineering Geology***	
	Engineering Geology	4
	Geomechanics	2
	Hydrogeology	2
	Environmental Geology	2
Total		10

Plus one additional two hour subject from either the above list or a list of other topics, subject to the approval of the Head of Department.

* An additional two hour subject may be prescribed by the program authority.
'Fieldwork of up to three days is a compulsory part of this program.

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, and a graduate course requiring one year of full-time or two years of part-time study leading to the award of the Graduate Diploma GradDip in Mining and Mineral Engineering.

3140
Mining Engineering - Full-time Course

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 School, and in the final year project.

In the undergraduate course it is compulsory for students to gain practical experience in the mining industry during successive long recesses. 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.

Year 1		**Hours per week** S1	S2
PHYS1002	Physics 1	6	6
CHEM1807	Chemistry 1 ME	6	0
MECH1300	Engineering Mechanics 1	4	0
MECH1500	Computing	0	3
MINE0110	Stress Analysis in Mining 1	0	3
MINE0210	Mining, Minerals and the Environment*	0	3
MINE0310	Descriptive Engineering	2	0
MINE0410	Technical Communication	0	3
MATH1042	Mathematics 1	6	6
		24	24

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

Year 2		**Hours per week**	
PHYS2920	Electronics	3	0
MATS9420	Materials for Mining Engineers	3	3
ELEC0802	Electrical Power Engineering	0	3
MINE0120	Stress Analysis in Mining 2	3	0
MINE1320	Fluid Mechanics and Thermodynamics	2	2
MINE1420	Mine Development*	2	0
MINE1720	Microcomputers Mining	2	0
MATH2009	Engineering Mathematics 2	4	4
MATH2819	Statistics SA	2	2
GEOL5211	Geology for Mining Engineers**1	2	2
SURV0441	Surveying for Engineers	0	4.5
	General Education Subject	2	2
		25	22.5

*Visits to mines and related undertakings are a requirement of this subject.
**Includes two compulsory field tutorials.

Year 3			
MINE1130	Mining Methods	2	2
MINE1231	Geomechanics A	3	0
MINE1232	Geomechanics B	0	2
MINE1330	Mine Transport	0	2
MINE1530	Power Supply in Mines	2	0
MINE1630	Excavation Engineering	2	2
MINE1730	Computer Applications in Mining	1	1

MINE1830	Mine Ventilation and Drainage	2	2
MINE1930	Mine Survey Camp	0	2.5
MINE2230	Mine Feasibility Studies	0	1
MINE4330	Mining Laboratory	2	2
MINE7342	Minerals Engineering Processes	3	3
SURV0580	Mining Surveying	3	0
GEOL5311	Geology for Mining Engineers 2*	4	4
	General Education Subject	2	2
		26	25.5

*A geology field excursion is held in Session 2.

Year 4

		S1	S2
MINE1140	Geotechnical Engineering	2	2
MINE1740	Mining Legislation	0	2
MINE2140	Mine Economics and Planning	4	2
MINE2240	Operational Management	2	2
MINE3040	Mine Safety Engineering	2	2
MINE4140	Minerals Industry Project	5	5
MINE4240	Industrial and Research Seminars	1	1
	General Education Subject	2	2

together with an approved group of three advanced subjects selected from the following

MINE1040	Underground Coal Mining*	2	2
MINE1440	Surface and Offshore Mining	2	2
MINE1840	Underground Metalliferous Mining*	2	2
MINE1940	Tunnel Engineering and Shaft Sinking	2	2
MINE7440	Mineral Process Technology	2	2
		24	24

Approval for a group of subjects must be obtained from the Head of School and must include at least one of the subjects marked. An elective subject of special interest to a particular student but not on the above list may be taken, with the approval of the Head of Department.

Graduate Study

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. Two half-session segments, each involving seven weeks full-time study, may be taken over consecutive years together with a research project equivalent to a full session's study. Projects may be studied on a part-time basis on topics within the candidate's field of employment. The courses may also be taken full-time over one year.

Courses currently offered are in the fields of Engineering Geology, Hydrogeology, Environmental Geology, Mineral Exploration, Exploration Geophysics and Exploration Geochemistry.

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 6,9,15 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.

Group A			**Hours Per Week Credit Points**
GEOL9444	Project (Engineering Geology)	-	6
GEOL9454	Project (Engineering Geology)	-	9
GEOL9464	Project (Engineering Geology)	-	15

Group B
The core subjects comprise

CIVL9788	Site Investigation	3	3
GEOL9010	Hydrogeology	3	3
GEOL9310	Hydrogeology	E	3
GEOL9030	Geological Engineering	3	3
GEOL9330	Geological Engineering	E	3
GEOL9040	Fundamentals of Geomechanics	3	3
GEOL9340	Fundamentals of Geomechanics	E	3
GEOL9060	Environmental Geology	3	3

The optional subjects would normally be chosen from

GEOL9070	Engineering Geophysics	3	3
GEOL9020	Geopollution Management	3	3
GEOL9320	Geopollution Management	3	3
GEOL0110	Geological Remote Sensing	3	3
MINE9414	Advanced Rock Mechanics	3	3
CIVL9790	Stability of Slopes	3	3
CIVL9790	Stability of Slopes	E	3

E= External

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.

8091
Mineral Exploration Graduate Course

Master of Applied Science
MAppSc

The course is designed to give broad training in techniques of modern mineral exploration to geologists and mining engineers. Practical aspects are emphasized and the field-laboratory project is oriented to current problems of mineral exploration. The duration of the course is one academic year of full-time study; the course is, however, divided into three units to facilitate part-time study. All students must complete Units A, B and C. Formal course work Units A and B accounts for 20-22 hours per week during Session 1. Some students depending upon their qualifications may be required to take a Special Project, GEOL0004 either as a pre or co-requisite. The courses within the three units may be varied at the discretion of the Head of the Department to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)

GEOL0010	Seminar
GEOL0020	Geology in Exploration 1
GEOL0030	General Introduction to Exploration Geophysics
GEOL0040	Introduction to Exploration Geochemistry
GEOL0050	Introduction to Data Processing and Interpretation
GEOL0060	Resource Economics 1
and *either*	
GEOL0070	Exploration Geophysics

or
GEOL0080 Exploration Project
MINE0130 Principles of Mining
and
MINE0440 Mining Economics
Seven days of field tutorials are an integral part of Unit A.

*These are one session subjects, ie weeks 1-14.

Unit B (Weeks 8 -14 Session 1)

GEOL0090 Advanced Geology in Exploration
GEOL0100 Resource Economics 2
GEOL0110 Remote Sensing
GEOL0120 Mining Law and Exploration Management
GEOL0240 Seminar
MINE0014 Exploration Drilling
and *either*
MINE0130* Principles of Mining
and
GEOL0440 Mining Economics
or
GEOL0130 Exploration Project

*These are one session subjects, ie weeks 1-14.

Unit C (Session 2)

GEOL0144 Field ! Laboratory Project

8092
Exploration Geophysics Graduate Course

Master of Applied Science
MAppSc

This is a specialized course in the techniques of exploration geophysics relevant to the current needs of the exploration industry. Practical applications are emphasized, and the field-laboratory project is designed to investigate aspects of specific exploration problems.

The duration of the course is one academic year of full-time study; the course is, however, divided into three units to facilitate part-time study. All students must complete units A, B and C. Formal course work Units A and B accounts for 20-22 hours per week during Session 1. Some students depending upon their qualifications may be required to take a Special Project, GOL0004 either as a pre or co-requisite. The courses within the three units may be varied at the discretion of the Head of the Department to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)

GEOL0010 Seminar
GEOL0020 Geology in Exploration 1
GEOL0030 General Introduction to Exploration Geophysics
GEOL0040 Introduction to Exploration Geochemistry
GEOL0050 Introduction to Data Processing and Interpretation
GEOL0060 Resource Economics 1
GEOL0070 Exploration Geophysics

Seven days field tutorials are an integral part of Unit A.

Unit B (Weeks 8-14 Session 1)

GEOL0210 Geological Interpretation
GEOL0220 Advanced Exploration Geophysics
GEOL0240 Seminar

Unit C (Session 2)
GEOL0234 Field ! Laboratory Project

8093
Exploration Geochemistry Graduate Course

Master of Applied Science
MAppSc

This is a specialist course in the techniques of exploration geochemistry covering general principles, specific field applications, laboratory techniques, and data display and interpretation. Practical applications are emphasized and the field-laboratory project is designed to investigate aspects of mineral exploration problems.The duration of the course is one academic year of full-time study; the course is, however, divided into three units to facilitate part-time study. All students must complete units A, B and C. Formal course work Units A and B accounts for 20-22 hours per week during Session 1. Some students depending upon their qualifications may be required to take a Special Project, GEOL0004 either as a pre or co-requisite. The courses within the three units may be varied at the discretion of the Head of the Department to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)

GEOL0010 Seminar
GEOL0020 Geology in Exploration 1
GEOL0030 General Introduction to Exploration Geophysics
GEOL0040 Introduction to Exploration Geochemistry
GEOL0050 Introduction to Data Processing and Interpretation
GEOL0060 Resource Economics 1
and *either*
MINE0130 Principles of Mining
and
MINE0440 Mining Economics
or
GEOL0080 Exploration Project
Seven days field tutorials are an integral part of Unit A.

*These are one session subjects, ie weeks 1-14.

Unit B (Weeks 8-14 Session 1)

GEOL0210 Geological Interpretation
GEOL0220 Advanced Exploration Geophysics
GEOL0240 Seminar

Unit C (Session 2)
GEOL0144 Field Laboratory Project

1000
Doctor of Philosophy (PhD) and
2000
Master of Science (MSc)

Research may be undertaken in fundamental or applied aspects of Geology. Collaborative programmes 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

Engineering and Environmental Studies

Engineering Geology
Geomechanics
Hydrogeology
Geopollution Management
Groundwater Geophysics
Groundwater Studies and Modelling
Waste and Landfill Disposal
Groundwater Contaminant Transport
Clays and Aggregates
Coastal and Esturine Geology

Fundamental Geological Studies

Palaeontology
Micropalaeontology
Petrology
Stratigraphy
Sedimentology
Structural Geology
Antarctic Geology

Centre for Groundwater Management and Hydrogeology

The Centre for Groundwater Management and Hydrogeology was established in 1987 as a Federal National Centre. It is a joint enterprise of the faculties of Applied Science and Engineering with general aims to research groundwater problems of strategic national importance and to co-ordinate and develop postgraduate courses, continuing education programs and to liaise with industry. The Centre offers specialized graduate courses in Hydrogeology and Groundwater Management and in Waste Management. A Graduate Diploma in Waste Management is also offered.

8021
Hydrogeology and Groundwater Management Graduate Course

Master of Applied Science
MAppSc

Core Subjects		**Credits**
GEOL9010	Hydrogeology	3
CIVL9880	Groundwater Modelling	3
MINE9374	Hydrogeochemistry	3
CIVL9875	Hydrological Processes	3
GEOL9090	Computing for Groundwater Specialists	

Options

GEOL9020	Geopollution Management
GEOL9080	Groundwater Geophysics
GEOL9100	Remote Sensing of Groundwater Resources
CIVL9843	Groundwater Hydraulics
CIVL9847	Water Resources Policy*
CIVL9848	Irrigation*
CIVL9850	Drainage of Agricultural land*

Project

GEOL9424	Groundwater Research Project (C18)
GEOL9434	Groundwater Project (C12)

*Existing subject not offered each year

8085
Waste Management Graduate Course

Master of Applied Science
MAppSc

Candidates are required to complete a course totalling at least 36 credits, made up of compulsory subjects, elective subjects and a project. The degree may be obtained internally on a full-time (normally 2 sessions of 18 credits) or part time normally 4 sessions of 9 credits basis. An external course program is also offered (normally over 4 sessions). Selection of subjects for formal course must be approved by Director of the Centre for Groundwater Management and Hydrogeology. A candidate must normally complete 18 credits of core subjects.

Core Subjects		**Credits**
CIVL9872, CIVL8872*	Management of Wastes	3
CIVL9873, CIVL8873*	Waste and Wastewater Analysis and Environmental Requirements	3
CIVL9874	Waste Management Science	3
CIVL9881, CIVL8881*	Hazardous Waste Management	

CIVL9883, CIVL8883*	Sources of Waste and Landfill Disposal	
FUEL5880, FUEL5881*	Unit Operations in Wastewater Sludge and Solids Management	3

Project

GEOL9504	Project	9
GEOL9514	Project	18
GEOL9604	External Project	9
GEOL9614	External Project	18

Elective Subjects

MINE1524	Mining Conservation	5
MINE5355	Mine Fill Technology	2
FUEL5911	Atmospheric Pollution Control Theory	3
FUEL5921	Atmospheric Pollution Control Practical Aspects	3
CIVL9857, CIVL8857*	Sewage Treatment and Disposal	3
CIVL9870	Hydraulics and Design of Water and Wastewater Treatment Plants	
CIVL9882, CIVL8882*	Industrial Waste Management	3
GEOL9010	Hydrogeology	3
GEOL9020, GEOL9320*	Geopollution Management	3
GEOL9060	Environmental Geology	3
GEOG9260	Medical Aspects	1
GEOG9270	Legislative Aspects	
SAFE9543	Management of Dangerous Materials	3
SAFE9242	Human Behaviour and Safety Science	3
CEIC5630	Industrial Water and Wastewater Engineering	3

* denotes external subject numbers.

5070
Waste Management Graduate Diploma Course

Graduate Diploma
GradDip

Candidates are required to complete a course totalling at least 30 credits made up of compulsory subjects, elective subjects and a 3 credit report. The diploma may be obtained full-time normally (2 sessions of 15 credits) or part-time 4 sessions basis. An external course program is also offered (normally over 4 sessions).

Selection of subjects for formal course work must be approved by the Director of the Centre for Groundwater Management and Hydrogeology. A candidate must normally complete 18 credits of core subjects.

Core Subjects		Credits	Session
CIVL9872, CIVL8872*	Management of Wastes	3	2
CIVL9873, CIVL8873*	Waste and Wastewater Analysis and Environmental Requirements	3	1
CIVL9874, CIVL8874*	Waste Management Science	3	1
CIVL9883, CIVL8883*	Sources of Waste and Landfill Disposal	3	1
FUEL5880, FUEL5881*	Unit Operations in Wastewater Sludge and Solids Management	3	1

* denotes external subject numbers

Elective Subjects

MINE1524	Mining Conservation
MINE5355	Mine Fill Technology
FUEL5911	Atmospheric Pollution Control Theory
FUEL5921	Atmospheric Pollution Control Practical Aspects
CIVL9857	Sewage Treatment and Disposal
CIVL9870	Hydraulics and Design of Water and Wastewater Treatment Plants
GEOL9010	Hydrogeology
	Geopollution Management
GEOL9060	Environmental Geology
GEOG9260	Medical Aspects
GEOG9270	Legislative Aspects
SAFE9543	Management of Dangerous Materials
SAFE9242	Human Behaviour and Safety Science
CEIC5630	Industrial Water and Wastewater Engineering

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
Mineral Engineering Graduate Course

Master of Applied Science
MAppSc

The course is under revision and will not be offered in 1991.

8056
Mining Geomechanics Graduate Course
Part-time (External)

Master of Applied Science
MAppSc

The course is offered to enable graduate mining engineers, geologists and civil engineers stationed in remote locations to carry out advanced theoretical and practical studies in geomechanics applicable to mining operations. Most of the work is completed by correspondence, with the exception of short annual residential schools of two weeks duration at the Kensington campus.

Enquiries from graduates living in the Sydney metropolitan area, as well as from graduates in other disciplines, are welcomed. In the latter case it may be necessary to include supporting subjects at undergraduate level within the Masters' program as approved by the Head of Department, up to a maximum of 25 per cent of the total program. It may also be necessary in some circumstances to take some prerequisite or co-requisite background undergraduate subjects, as directed by the Head of Department.

The program consists of formal study equivalent to six hours of lectures per week, for three years on a part-time external basis. One third of total program consists of a project on an approved topic covering a field or laboratory investigation of a mining geomechanics problem.

Six of the subjects, in addition to the project, form a compulsory core strand. These are augmented by a range of elective subjects. Two electives are to be selected for study, subject to the approval of the Head of School and availability of the topics.

Assessment is by formal examination at appropriate country centres where necessary and by assignment work.

Year 1		**Hours per week** S1	S2
GEOL9030	Fundamentals of Geomechanics	3	0
MINE5155	Rock Mechanics Measurements	3	0
GEOL9040	Geological Engineering	0	3
One elective subject		0	3

Year 2			
MINE9415	Advanced Rock Mechanics	3	0
MINE4055	Numerical Methods in Geomechanics	3	0
MINE4155	Stability of Slopes	0	3
One elective subject		0	3

Year 3			
MINE4555	Mining Geomechanics Project	6	6

Elective Subjects to be chosen from

GEOL9010	Hydrogeology
MINE5355	Mine Fill Technology
MINE5455	Advanced Rock Cutting Technology
MINE5555	Blasting Technology

5040
Mining and Mineral Engineering Graduate Diploma Course

Graduate Diploma
GradDip

The Graduate Diploma course in Mining and Mineral Engineering is designed to provide professional training for graduates in Science, Applied Science or Engineering who wish to specialize in the fields of mining and mineral beneficiation. The course is concerned primarily with instruction in the scientific and engineering principles associated with the mining and beneficiation of minerals and coal.

The Graduate Diploma in Mining and Mineral Engineering (GradDip) will be awarded on the successful completion of one year full-time or two years part-time study. The course is a blend of lecture and laboratory work and allows the choice of elective specialization in either mining engineering or mineral processing and coal preparation.

It should be noted that some degree of specialization will be possible in the laboratory investigations. When appropriate, certain sections of the course may be offered as a unit over a short period of time to permit mineral industry personnel to attend the advanced course in a particular area of that discipline.

Fulltime Program		**Hours per week** S1	S2
MINE0130	Principles of Mining	2	0
MINE2340	Mineral Economics	1	1
MINE1114	Mining Engineering	3	3
MINE3114	Mineral Beneficiation	0	3
MINE7140	Mineralogical Assessment	1	0
MINE7341	Mineral Process Engineering	2	0
MINE1224	Mining Engineering Technology *or*	3	3
MINE3224	Mineral Beneficiation Technology	3	3
MINE1324	Mining Engineering Laboratory and Project *or*		
MINE3324	Mineral Engineering Laboratory	3	3
		15	13

Year 1 - Part-time

MINE0130	Principles of Mining	2	0
MINE2340	Mining Economics	1	1
MINE3114	Mining Engineering	3	3
MINE7140	Mineral Beneficiation	0	3
MINE7140	Mineralogical Assessment	1	0
MINE7341	Mineral Process Engineering	2	0
		9	7

Year 2 - Part-time

MINE1224	Mineral Engineering Technology	3	3
	or		
MINE3224	Mineral Beneficiation Technology	3	3
MINE1324	Mining Engineering Laboratory and Project or	3	3
MINE3324	Mineral Engineering Laboratory	3	3
		6	6

When appropriate, up to 3 hours per week may be selected from approved courses available within this Department or offered by other Schools within the University.

Key Centre for Mines

The Key Centre for Mines is a joint initiative of the Universities of New South Wales and Wollongong, with seed funding from 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.

Mining Management Graduate and Graduate Diploma Courses

Master of Mining Management MMinMgmt

Graduate Diploma in Mining Management GradDipMinMgmt

The courses have been designed to give mining personnel the opportunity to extend their career paths into management level. Candidates will be able to select course work modules from 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 will be equivalent to a one semester session.

It is anticipated that candidates will come from a wide range of educational and training backgrounds. The normal entry qualifications are a relevant four-year degree or equivalent, particularly where this is demonstrated by membership of a professional organisation. A preliminary program is available for candidates who do not fully meet the normal requirements.

Five modules will be required for the GradDipMinMgmt with a minimum of two from either the Management or the Science and Technology Streams. For the Master of Mining Management it will be necessary to complete eight modules, with a minimum of three from either stream. The Master's program also includes an industry-based research project equivalent to one third of the course. The courses will be articulated in a way that allows movement between the two programs; a graduate of the GradDipMinMgmt course will be able to continue to a MMinMgmt by completing a further three modules and the research project.

Assessment is by formal examination at appropriate country centres where necessary and by assignment work.

The topics have been selected from pre-existing subjects, but all will be adapted to suit the short-course module format. Not all topics will be available in any one year. It is proposed that a module on Environmental Management will be a compulsory component of both courses.

Science and Technology Stream Subjects from the School of Mines.

Topic Number	Topic*
MINE1224	Mining Engineering Technology
MINE1514	Ground Control and Excavation Engineering
MINE1534	Environmental conditions in Mines
MINE1544	Rock Excavation and Transportation
MINE3114	Mineral Benefication
MINE5255	Strata Control Engineering
GEOL9060	Environmental Geology
GEOL9340	Geological Basis of Geomechanics

*Equivalent and or additional courses to be determined by the Head of the School of Mines.

Management Stream Subjects from the Faculty of Commerce and Economics.

Topic Number	Topic*
ACCT5940	Accounting and Financial Management A
ACCT5956	Management Planning and Control
INFS5957	Operations Research for Management I
MARK5903	International Marketing
MARK5905	Marketing Strategy
IROB5701	Industrial Relations A
IROB2716	Industrial Conflict
FINS5517	Investment Analysis and Management
LEGT5541	Company Law
LEGT5511	The Legal Environment of Business

*Equivalent and or additional courses to be determined by the Dean of the Faculty of Commerce and Economics.

Undergraduate Study

Department of Mining Engineering

MINE0110 Stress Analysis in Mining 1 S2 L1 T2

Concepts of stress and strain. Mohr's circle diagrams. Introduction to elastic theory. Simple beam and column theory. Introduction to computer methods of stress analysis in mining. **(Old No. 7.011)**

MINE0120 Stress Analysis in Mining 2 S1 L1 T2

Prerequisite: MINE0110

Statics in mining systems. Bending moments, shear force and torsion. Combined stresses, calculation of principal stresses and strains. Brittle behaviour and anistropy. Time-dependent properties and creep. Computer methods of stress analysis. **(Old No. 7.012)**

MINE0130 Principles of Mining S1 L2

Mining Engineering terminology and definitions. Drilling techniques for production blasting and exploration. Explosives and rock fragmentation processes. Mine development, access to mineral deposits and their exploitation. Surface and underground techniques. Methods of working coal and metalliferous deposits. Methods of ground support. Offshore mining; the ventilation and drainage of mines; mine transport and materials handling. Mine safety engineering. **(Old No. 7.013)**

MINE0210 Mining, Minerals and Environment S2 L2 T1

Mineral deposits ! metallic, non-metallic and fuels. Elements of prospecting and exploration. Basic mining techniques ! mine development, mineral extraction and abandonment of mines. Mining services. Unit operations of mineral processing and extractive metallurgy. The engineer and society. Professional ethics. Community relationships. Alternative land uses. Disposal of mine waste and its commercial exploitation. Mine lease rehabilitation and restoration. Pollution monitoring and control. Environmental impact statements. Legislative controls on mining and on mineral exports. **(Old No. 7.021)**

MINE0310 Descriptive Engineering S1 L1 T1

Aspects of engineering technology required for a full understanding of the mining engineering course. Internal combustion and compression ignition engines, portable diesel power. Gearboxes, automatic transmissions. Flexible couplings, bearings, gear trains, belt drives, hydrokinetic and hydrostatic drives. Hydraulic circuits. Glands, seals, stuffing boxes. Rotary pumps and reciprocating pumps. Compressed air generation and reticulation. Track-laying vehicles. Braking systems ! drum, disc and wet plate. Boilers and power generation. Electrical control and drive systems for mining machinery. Basic ergonomics for machine controls. **(Old No. 7.031)**

MINE0410 Technical Communication S2 L1 T2

Introduction to engineering drawing ! Australian standards, first and third angle projections, isometric drawing. Engineering sketches, presentation of oral and written data, engineering graphics. Meetings and staff training. Report writing - analysis of experimental data and presentation of graphs and figures. **(Old No. 7.041)**

MINE0440 Mining Economics S1 L2 T2

Aspects of micro- and macro-economics. Theory and practice of resource sampling. Valuation of mineral properties and mining projects including reserve calculation by traditional and geostatistical methods. Geological reserves and mining reserves. Interaction of grade, tonnage, mining recovery and mining method. Financing of mining ventures. Types of mining companies ! private, public, no-liability. State ownership and participation. Investment decision analysis ! cash flow models, sensitivity analysis. Marketing of mineral commodities. **(Old No. 7.044)**

MINE1040 Underground Coal Mining F L1 T1

Prerequisites: MINE1130 and MINE1140, MINE1231, MINE1830.

Effect of surface improvements and structural geology on mine layout. Influence of coal seam properties on choice of extraction height and working section. Coal properties related to machine extraction. Pillar and coalface layouts to optimise strata control. Face and roadway support systems. Mechanised extraction: cutting machines, their stability and steering, armoured face conveyors and stage loaders, coal clearance systems, coal bunkerage. Mechanisation problems in thin, thick, steep and faulted seams. Multi-seam layouts. Limitations on face advance rate. Logistics of high-speed extraction ' supplies, manpower, rapid transfer of face equipment. Packing and stowing. Hydraulic mining. Supervision and performance criteria. **(Old No. 7.104)**

MINE1130 Mining Methods F L2

Prerequisite: MINE1420

Technical and environmental considerations for mining by surface or underground methods. Permanent mining facilities and mine development. *Metalliferous deposits:* underground and surface mining. Sublevel open stoping, sublevel caving, cut and fill stoping, other underground mining methods. Pillar recovery. *Coal and lignite deposits:* occurrence in Australia. Surface mining methods ! considerations of terrain, mining of single, multiple, thin, thick and steeply inclined seams. Underground mining methods ! use of panels, pillared, shortwall and longwall mining of thin, thick, multiple and steeply inclined seams. Abandonment of mines. **(Old No. 7.113)**

MINE1140 Geotechnical Engineering F L1 T1

Prerequisites: MINE1231, MINE1232.

Stresses around mine openings: magnitude and distribution, determination by analytical methods, analogue and mathematical modelling, in situ measurements. Energy changes caused by excavations. Initiation and propagation of failure in rock structures. Stability of excavations: natural and artificial supports, permanent and temporary supports. Design of support systems. Stability of rock slopes. Ground control measurements. Rockbursts. Outbursts in coal. Mining subsidence, nature effects, prediction and control. **(Old No. 7.114)**

MINE1231 Geomechanics A **S1 L1.5 T1.5**

Prerequisite: MATH1032 Co-requisite: MINE4330.

Rock mass, rock material and discontinuities. Geomechanical properties of discontinuities ! orientation, spacing, persistence, roughness, apertures and filling. Rock mass classification. Rock strength and deformability, concepts and definitions, common laboratory strength tests, measurement of deformability by static tests, dynamic measurements, influence of time on rock deformation. Strength criteria for isotropic and anisotropic rock material, shear behaviour of discontinuities, behaviour of rock masses containing discontinuities. Pre-mining state of stress and its measurement. **(Old No. 7.1231)**

MINE1232 Geomechanics B **S2 L1 T1**

Prerequisite: MATH1032 Co-requisite: MINE4330.

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. **(Old No. 7.1232)**

MINE1320 Fluid Mechanics and Thermodynamics **F L1 T1**

Prerequisites: MINE0110, MECH1300, PHYS1002, MATH1032. Co-requisite: MATH2001.

Fluid properties, fluid statics, fluid flow ! laminar and turbulent. Continuity equation, energy equation, momentum equation. Flow measurement. Pumps and pump characteristics. Energy losses in pipelines and open channels. Boundary layer theory. Dimensional analysis. Thermodynamic systems - states, processes and properties. Energy of a system, first and second laws of thermodynamics. Reversibility, ideal gas laws, cycles for heat engines, heat pumps, compressors and refrigerators, psychrometrics. **(Old No. 7.132)**

MINE1330 Mine Transport **S2 L2 T1**

Transport requirements for minerals, waste, supplies and people. Mine winding systems for shafts and drifts. The mechanics of hoisting. Mine ropes and chains. Winding cycle diagrams and calculations. Surface and underground haulage arrangements. Secondary transport systems. Rope haulage, aerial reopeways, monorails, belt conveyors, locomotive haulage. Track mounted, crawler and trackless methods. Elements of soil vehicle mechanics applied to mining equipment. Primary systems. Chain, screw and bucket conveyors and elevators. Shaker and vibratory conveyors. Hydraulic and pneumatic transport methods. Chutes and bunkers. Design of transport systems. **(Old No. 7.133)**

MINE1420 Mine Development **S1 L2**

Prerequisite: MINE0210.

Infrastructure requirements for mines and mining communities. Prospecting, exploration, mine feasibility studies, statutory requirements. Surface requirements and layout for winding, ventilation, drainage, mine services, administration, welfare. Mine working drawings. Provision of primary underground access by shaft, drive, drift, decline and incline, adit, raise, winze. Development through water-bearing and unconsolidated ground. Explosives applied in mine development. Development by tunnelling machine. Equipping shafts. Ground support during development. Emergency egress requirements. Development of surface metalliferous and coal mines. Spoil and waste disposal, land restoration and other environmental considerations. Preparation of Environmental Impact Statements. **(Old No. 7.142)**

MINE1440 Surface and Offshore Mining **F L1 T1**

Prerequisite: MINE1130.

Surface mining of tabular and other deposits, general methods, current trends. Planning and design of surface mines; reserves, scale of operatio9ns, surface facilities. Stripping ratio, pit limit determination by manual and computer-based methods, phase plans, operating layouts, scheduling. Mining systems: equipment selection, type, capacity and fleet size, operational costs, maintenance. Slope stability: pit walls, spoil piles, ground water control. Surface rehabilitation. Stream and offshort dredging for metals, minerals, gemstones and construction materials. Evaluation of marine deposits. Dredge design and operation. Beach sand mining. Deep sea mining. International agreements and law. Project. **(Old No. 7.144)**

MINE1530 Power Supply in Mines **S1 L1 Tl**

Prerequisite: MINE0310, MINE1320, PHYS2920, ELEC0802.

Electric power distribution, mine cables, switchgear. Flameproofing and intrinsic safety, fault protection. Oil hydraulic power. Fluid characteristics. Components and circuits. Pumps, motors, valves. Speed and torque control. Compressed air: generation, distribution, applications and equipment, compressors. Control theory, automatic control in mining. **(Old No. 7.153)**

MINE1630 Excavation Engineering

Rock drilling and boring. Percussive, rotrary, hybrid and exotic methods. Drilling patterns for shafts, headings, faces and benches. Classificatio9n of chemical explosives and their application. Detonation. Misfire procedures. Alternative explosive agents. Special blasting techniques including presplitting, profiling, trenching, casting and demolition. Environmental considerations, handling and storage of explosives, vibrations. Nuclear blasting. Rock fragmentation by machine. Principles of rock cutting mechanics. Drag picks and free rolling cutters. Hydraulic mining. Water jet cutting. Thermal, electrical, ballistic and other novel fragmentation techniques. Rock cutting tool materials. Effect of tool metallurgy on ear and fracture resistance. Methods of assessment rock cuttability. The design of cutting arrays for machine mining. **(Old No. 7.163)**

MINE1720 Microcomputers in Mining **S1 L1 T1**

Types of microcomputers, components, operating systems. Spread sheets, data bases and word processors. Software applicable to mining. Use of microcomputers for control, minitoring and data acquisition. **(Old No. 7.172)**

MINE1730 Computer Applications in Mining **F L1**

Prerequisite: MINE1720.

Simulation of mining problems. Application of selected programs to exploration, operations, economics and design. **(Old No. 7.173)**

MINE1740 Mining Legislation **S2 L2**

An appreciation of the laws relating to mining practice and to safety and health in mines. **(Old No. 7.174)**

MINE1830 Mine Ventilation and Drainage **F L2 T1**

Prerequisites: MINE1320, MINE1420. Co-requisite: MINE4330.

Mine ventilation ! practice in mines, forces causing airflow, resistance of workings and distribution of mine air, network analysis, fans and their operation, auxiliary ventilation calculations, economic size of airways. Ventilation surveys. Mine gases ! hazards, accurrence, detection, monitoring and control. Airborne dust - physiological effects, sampling, measurement and analysis, sources and control. Mine climate ! physiological effects, air cooling power, factors affectring mine climate and control. Ventilation planning ! airflow requirements based on gaseous, airborne dust and heat pollutants.

Mine drainage ! engineering hydrology, sources of mine water, forecasting water inflows, drainage and dewatering, pumps and pumping. **(Old No. 7.183)**

MINE1840 Underground Metalliferous Mining **F L1 T1**

Prerequistes: MINE1130.

Production, development and resource scheduling. Main development, slope development. Cyclic and continuous production systems ! slope, haulage, hoisting; use of stockpiles and multi-face production systems. Optimum ore fragmentation, material flow in passes. Pillar recovery. Optimum fill selection. Preparation and placement of mine fills. Bulkhead design, fill dewatering. Ground support during stoping. Practice in Australasia. Mine design project. **(Old No. 7.184)**

MINE1930 Mine Survey Camp **S2 T2.5**

Exercises in surveying at one or more mines, in close collaboration with mining company mine surveying personnel.

MINE1940 Tunnel Engineering and Shaft Sinking **F L1 T1**

Not available to students who have completed MINE1640.

Scope for tunnels. Site investigation. Primary excavation in soft and hard ground. Drilling and blasting. Tunnelling shields, full face boring, partial face machines. Debris disposal. Temporary and permanent support. Ground stability. Sub-aqueous tunnels. Cut and cover tunnels, immersed tubes. Compressed air working. Environmental considerations. Tunnel services, ventilation, drainage and lighting for road and all-rail tunnels. Shaft sinking in different ground conditions. Ground treatment before excavation. Shaft lining. **(Old No. 7.194)**

MINE2140 Mine Economics and Planning **S1 L2 T2 S2 L1 T1**

Prerequisite: MINE1130, MINE2230.

Resource sampling, reserve calculations by traditional methods and by geostatistics, feasibility studies including calculation of capital costs and operating costs, company taxation. Feasibility study project. Project financing ! equity, debt, leasing, non-recourse financing, joint ventures. Company types and structures, capitalisation, documents of incorporation and of annual reports. Commodity marketing, metal exchanges, producer pricing, price forecasting. Mining law, mineral ownership, federal and state responsibilities, royalties. Projectr control, contracts, insurance. Operating cost systems, discounted cash flow techniques appllied to mine expansion and system modification. Replacement of mine plant. **(Old No. 7.214)**

MINE2230 Mine Feasibility Studies **S2 L1**

Elements of mineral project cash flow. Application of numerical discounted cash flow techniques to economic analysis of mineral projects. Parameter sensitivity calculations. **(Old No. 7.223)**

MINE2240 Operational Management **F1 L1 T1**

Approaches to management study: managerial functions, objectives and decision making, organisation concepts, elementary industrial phsychology, work measurement and appraisal, industrial relations, communication, negotiations, recruitment, selection and training of personnel. Operations research, control networks, decision analysis, linear programming, queueing theory, simulation, purchasing and stores policy, management accounting and budget controls, reliability engineering, maintenance procedures, personnel and materials management. **(Old No. 7.224)**

MINE2340 Mineral Economics **F L1**

Business cycles. Theory of wages. Types of mine, contracts. London metal exchange. The economics of processing after the mine lease. National stockpiles. Depletion of world resources. Prediction techniques for supply and demand. Type of company, statutory duties of directors. **(Old No. 7.234)**

MINE3040 Mine Safety Engineering **F L1 T1**

Safety precautions against outbursts. Methane drainage. Fires and explosions in coal and metalliferous mines, explosible dust. Spontaneous combustion. Water hazards in mines and precautions against inundation. Mine rescue and recovery. Noise measurement, hearing hazards and control. Mine lighting. Poisons and general toxic hazards. Radiation hazards. Loss control, accidents, accident investigations, safety programs. Safety and health legislation. **(Old No. 7.304)**

MINE4140 Minerals Industry Project **F T5**

Candidates are required to submit a disseration 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. **(Old No. 7.414)**

MINE4240 Industrial and Research Seminars F L1

The program includes two types of seminar. One deals with research work being undertaken or recently completed by members of the School of Mines. The other involves engineers and scientists from industry, other University schools and research establishments discussing projects of special or topical interest in mining and allied fields. **(Old No. 7.424)**

MINE4330 Mining Laboratory F T2

Co-requisites: MINE1231, MINE1232.

A program of laboratory experiments for Year 3 students requiring the submission of appropriate laboratory reports related to the syllabus areas of the the co-requisite subjects. **(Old No. 7.433)**

MINE6100 Introduction to Mining and Mineral Engineering S1 L2

Mineral deposits, metallic, non-metallic and fuels. Elements of prospecting and exploration. Basic mining techniques. Mining phases: development, exploitation, and withdrawal. Mining and the environment. Mining services. Relevance of basic science and engineering subjects to mining design and operations. The unit operations of mineral processing and extractive metallurgy, related to end use of product and its market value. Safe disposal of waste material. **(Old No. 7.610)**

MINE6210 Mineral Enginering Science 1 S2 L2 T1

Application of the principles of stoichiometry and thermodynamics to mineral processing and extractive metallurgy. Review of the laws of thermodynamics, material and energy accounting, the thermodynamic data sources, chemical and phase equilibria in pyrometallurgical systems, computer methods, theory of metal solutions, slags, fused salts and mattres. Application to combustion of fuels, roasting, chlorination, reductgion of oxides, smelting of sulphides and refining of metals. **(Old No. 7.621)**

MINE6220 Mineral Engineering 1 F3

Unit 1 Physical Operations in Mineral Processing

Basic theory and applications to unit design of the physical operations in mineral beneficiation, breakage and comminution, screening, classification, flotation, gravity concentration, minor separation processes and de-watering. Integration of equipment into complete flowsheets, case studies of operating plants to illustrate the factors that influence the flowsheet design.

Unit 2 Process Design for Mineral Extraction

Mineral extraction processes in terms of mechanisms and achievments. Ovberall extraction schemes. Quantitative analysis and computation in the solution of mineral engineering problems involving fluid flow, heat transfer, statistics, and mineralogy. End uses of minerals, the technical aspects of the market requirements and how these influence mineral processing and extractive metallurgy. **(Old No. 7.622)**

MINE6230 Mineral Engineering Laboratory 1 S2 T3

Laboratory exercises relevant to both mineral and metallurgical processing covering: experimental design, the gathering and interpretation of data used for the assessment of ores and minerals in order to determine the processes most suitable for their beneficiation and subsequent refinement or utilization. **(Old No. 7.623)**

MINE6310 Mineral Engineering Science 2 S1 L5

Unit 1 Physical and Chemical Characterisation of Mineral Particles

Physico-chemical and electrical characteristics of surfaces. Surface phenomena in flotation. Fluid particle dynamics and the characteristics of ores and ore pulps in relation to the handling of these materials. Fine particle statistics in mineral beneficiation.

Unit 2 Aqueous Thermodynamics and Hydrometallugical Processes

Application of principles of aqueous thermodynamics, electro-chemistry, chemical and electrochemical kinetics, to hydrometallugical processes: leaching of minerals and concentrates, solution purification, precipitation, and other separation processes, ion-exchange and liquid-liquid extraction.

Unit 3 Elements of Geomechanics

Elements of geomechanics in relation to the classification, testing, handling and disposal or rocks and soils. **(Old No. 7.631)**

MINE6320 Mineral Engineering 2 F L3

Unit 1 Plant Performance

Plant performance monitoring and the analysis, computation and reporting of operating data. Analysis and evaluation of mineral processing operations and extractive processes.

Unit 1 Process Design 1

Integrated design of mineral processing and extraction circuits. The application of reaction engineering principles to the design and evaluation of mineral and metallurgical reactors and processes with consideration of unsteady state processes. Identification of the information required to select and design processes, dealing with deficiencies in information. Development of communication skills through the collection and presentation of technical information. **(Old No. 7.632)**

MINE6330 Mineral Engineering Laboratory 2 F T3

Exercises in mineral processing and extractive metallurgy designed to develop investigational skills for obtaining quantitative relations for process phenomena, testing the performance of a machine or reactor, simulating a process by a computer program, instrumental analysis, quantitative measurements of the properties of minerals and particles, solutions and gases. Collection and interpretation of data from operating plants. Development of proficiency in technical report writing, and communication. **(Old No. 7.633)**

MINE6420 Mineral Engineering 3 F L3 T3

Unit 1 Control and Simulation

Problems in the automatic control and on-line analysis of mineral and metallurgical processes.

Unit 2 Process Design 2

Methodologies and mineral engineering investigations, including statistical design of testwork, development of

quantitative empirical relationships, sensitivity analysis, and development of theoretical relationships. Development of a systematic approach to technical decision-making, with industrial case studies.

Unit 3 Environmental Engineering

Origin and control of environmental hazards in mineral engineering. Disposal of waste materials. **(Old No. 7.642)**

MINE6430 Mineral Engineering Projects and Laboratory **S1 T6 S2 T9**

One major investigation based on a selected problem in mineral engineering. A second problem in process selection and design based on quantitative data for various options. A third project may be included as an exercise in selection and evaluation of information from the literature for a specific case study Seminars. **(Old No. 7.643)**

MINE7140 Mineralogical Assessment **S1 L1**

Assessment of the physical and chemical properties of economic minerals. Significance of the textures of minerals on the selection of mineral beneficiation processes. Destructive and non-destructive testing of bore cores. Factors influencing effective comminution and liberation. **(Old No. 7.714)**

MINE7250 Chemical and Extractive Metallurgy 1 **S2 L2 T1**

Metallurgical thermodynamics and kinetics. Review of the First Law of Thermodynamics, Thermochemistry, and material balance calculations. Review of the Second Law, free energy function, statistical interpretation of entropy, and Third Law. Phase equilibria in a one component system. Reactions involving gases, and gases with pure condensed phases. Graphical representation of equilibria. Ellingham diagrams and Kellog predominance area diagrams. Tabulation of thermodynamic data and sources of data. Introduction to heterogeneous kinetics, reactions of a solid particle with a gas. **(Old No. 7.725)**

MINE7340 Mineral Process Engineering **S1 L2 T1**

(Old No. 7.734)

MINE7341 Mineral Process Engineering **S1 L2**

The necessity for minerals beneficiation. Mineralogical assessment. Comminution: fracture, liberation, size-criteria, energy-size relationships. Crushing, grinding and attrition. Screening and classification, cyclones. Concentration processes, density, electrical, magnetic and other physical methods. Interfacial phenomena. Surfactants. Flotation. Liquid-solid separation: flocculation, thickening, agglomeration, filtration. Materials balances. **(Old No. 7.7341)**

MINE7342 Minerals Engineering Processes **F L1 T2**

Beneficiation requirements. Scope of mineral processing. Sampling and mineralogical assessment. Comminution, fracture, liberation, size criteria, energy-size relationships. Crushing and grinding. Screening and classifying. Fluid dynamics of suspensions. Attrition. Concentration processes: density, electrical, magnetic and other physical methods. Cyanidation, amalgamation, leaching, solvent extraction and ion exchange. Interfacial phenomena. Surfactants. Flotation. Liquid-solid separation: flocculation, thickening, agglomeration, filtration. Drying. Materials balances. **(Old No. 7.7342)**

MINE7350 Chemical and Extractive Metallurgy 2 **S1 L2 T1.5**

Metallurgical thermodynamics. Thermodynamic behavious of solutions, activity of a component in solution, Gibbs-Duhem equation, free energy of solution, properties of ideal and non-ideal solutions, integration of Gibbs-Duhem equation and relationship to activity determinations, regular solutions and a quasi chemical model of solutions. Free energy-composition and phase diagrams of binary systems, alternative standard states, relationship among phase diagrams, free energy and activities. Thermodynamics of interfaces. Equilibrium between phases of variable composition, Gibbs phase rule. Solutions containing several solutes. Estimation of activities in ternary systems. Galvanic cells. Structure and thermodynamic properties of slags. **(Old No. 7.735)**

MINE7440 Mineral Process Technology **F L1 T1**

Physics and chemistry of surfaces. Measurement of surface properties. On-stream and laboratory analysis and measurements. Laboratory and pilot testing. Flowsheet design. Equipment selection. Plant layout. Monitoring and control systems. Process evaluation. Storage and blending. Materials handling. Waste disposal and pollution control. Waste treatment. Process simulation. Marketing. **(Old No. 7.744)**

MINE7451 Advances in Pyrometallurgy **S1 or S2 L2**

Advances in pyrometallurgy relasted to extraction and refining processes used for recovery of ferrous and non-ferrous metals. **(Old No. 7.7451)**

MINE7452 Advances in Hydrometallurgy **S1 or S2 L1 T1**

A critical analysis of: recent industrial and research developments in extraction metallurgy: major problems that are the subjects of current researchb and development in extractive metallurgy; the variety of methods available for research and development. **(Old No. 7.7452)**

MINE7460 Mineral Process Chemistry

Sources of equilibrium stability data, methods of presenting in graphic forms thermochemical data for application to interpreting the chemical reactions and mechanisms of aqueous process. Overall schemes of metal extraction. Analysis and resolution in the processing and metalliferous raw material. Effects of minor components on overall scheme and efficts of mineralogy on process performance. Analysis of testwork methods. Process chemistry of the smelting and refining of ferrous, non-ferrous and recycled materials. Fundamental principles of metal extraction and plant practice. Analysis of recent research and industrial development in hydrometallurgy. Thermodynamic and kinetic considerations in electrometallurgy. Electrochemical reactor and cell designs. Electrochemistry in industrial processes. **(Old No. 7.746)**

MINE7480 Technical Decision Making S1 or S2 L1 T1

A systematic approach to technical decision-making involving problem analysis, identification of options, data collection, selection of criteria, application of criteria and implementation. Case studies in decision-making based on specific, topical projects in industry. **(Old No. 7.748)**

Department of Applied Geology

Field tutorials are an essential part of these subjects and are held during weekends and/or recesses. Dates and costs are available during the first week of the subject. Attendance is compulsory.

GEOL1101 Geological Processes S1 L3 T3

Stream 1

Constitution of the Earth: The Earth and the Solar System. The interior of the Earth: the crust and its chemical composition, gravity and isostasy. Minerals and rocks, economic mineral deposits. *Geological Processes.* The origin of igneous rocks, plutonism and volcanism. The geological cycle. Weathering processes, soil formation and landforms. The origin of sedimentary rocks, transportation, deposition, lithification. Arid, glacial and periglacial processes. Geological time. Metamorphism and metamorphic rocks. Structural geology, classification and origin of faults and folds. Quaternary stratigraphic sequences, neotectonics. *Field work* of up to two days is a compulsory part of the subject.

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. **(Old No. 25.110)**

GEOL1201 Geological Environments L3T3

Prerequisites:

HSC Exam Score

	Range Required
2 unit Mathematics* *or*	55-100
3 unit Mathematics *or*	1-50
5 unit Mathematics	1-100
and	
2 unit Science (Physics) *or*	53-100
2 unit Science (Chemistry) *or*	53-100
2 unit Science (Geology) *or*	53-100
2 unit Science (Biology) *or*	53-100
4 unit Science	1-50
3 unit Science	90-150
and	
GEOL1101	

**This refers to the 2 Unit Mathematics subject. It does not refer to the subject 2 Unit Mathematics (Mathematics in Society).*

Geological Environments. Introductory palaeontology, including the evolution of life, invertebrates and vertebrates. Principles of stratigraphy. The stratigraphy of New South Wales: Broken Hill, Lachlan, Orogen, New England Fold Belt and Sydney Basin. Introductory stratigraphy of Australia from the Precambrian to the Recent. The mineralogical study of rocks, techniques and significance of mineralogy. Structural geology, stereographic and statistical treatment of structural data. *Geological Dynamics.* The evolution of ocean basins, sea-floor spreading and sea-level changes. Climates of the past. Geophysical methods of exploration; seismology and earthquake prediction. Plate tectonics and continental drift. *Field work* of up to four days is a compulsory part of the subject. **(Old No. 25.120)**

GEOL2111 Earth Materials 1 S1 L2 T4

Prerequisite: GEOL1201

Mineralogy. Principles of optical crystallography and the use of the polarizing microscope. Chemical and physical properties of rock forming minerals. Mineral identification. *Igneous Petrology.* Occurrence., classification and origin of igneous rocks. Fractional crystalization and differentiation. Partial melting. Simple binary melting diagrams. Igneous petrololgy relating to plate tectonics. *Practical.* Macroscopic and microscopic examination of rock forming and ore minerals and igneous rocks in the field and the laboratory. *Field work* of five days is a compulsory part of the subject. **(Old No. 25.211)**

GEOL2121 Earth Environments 1 S1 L3 T3

Prerequisite: GEOL1201

Sedimentology. Flow regimes and bedding forms, sedimentary structures. Modern and ancient sedimentary environments of deposition: alluvial, nearshore, 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 stratigraphic distribution of invertebrates, including Foraminifera, Brachopoda, Mollusca, Arthropoda, Protochordata and Echinodermata. Introductory paleobotany, Biogeography. Trace fossils. Reef building organisms and the evolution of reefs. Field work of up to five days is a compulsory part of the subject. **(Old No. 25.212)**

GEOL2211 Earth Materials 2 S2 L3 T3

Prerequisite: GEOL2111

Sedimentary Petrology. The influence of transportation, deposition and diagenesis on the composition, texture and structure of detrital sedimentary rocks. The non-classic sedimentary rocks including phosphates, evaporites; ferruginous and silceous deposits. *Metamorphic Petrology.* Origin and classification of metamorphic rocks as an aid in understanding common mineral assemblages. Petrogrpahic 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. *Field work* of up to four days in a compulsory part of the subject. **(Old No. 25.221)**

GEOL2230 Mathematical Geology 1 **S2 L2 T1**

Prerequisite: GEOL1201

Geological Statistics. Measurement scales in geology. Probability distributions and their properties; sampling and test of significance. Application of these techniques using geological data. *Geological Computing:* FORTRAN programming; test editing; control language for VAX and CYBER. **(Old No. 25.2261)**

GEOL2231 Earth Physics **S2 L2 T4**

Prerequisite: GEOL1101.

Global Geophysics. Principles of gravity, geomagnetism, palaeomagnetism, geothermy and seismology and their relation to shape, internal constitution, dynamic processes and major tectonic features of the earth. *Photogeology.* The use of air photos for geological mapping and geomorphological evaluation of land. Techniques and principles of photo-interpretation and multi-band photography. Photo-interpretation of folds, faults, joints, bedding, limestone, intrusive igneous volcanic rocks, alluvial fans, terraces, slopes, landslides, coastal and tropical landforms. Relationships between geology, drainage, soil and vegetation, orebody expression gossans, colouration halos. An introduction to remote sensing. *Geological Surveying.* Levels, tachometers and theodolites. Field techniques. Precision of angular measurements. Stadia surveying. Levelling. Field computations. Closed and open traverses. Coordinates and their computation. *Field work* of two days is a compulsory part of the subject. **(Old No. 25.223)**

GEOL3111 Earth Materials 3 **S1 L2 T4**

Prerequistie: GEOL1201

Mineralogy. Principles of X-ray powder diffractometry and the use of X-ray powder cameras and diffractometers. Elementary stereology. Laboratory methods of mineral separtation. Mineral characterization. *Geochemistry.* Accuracy, precision and quality of geochemical data. Graphical display of analyses. Norms. The distribution of elements in terrestrial rocks. 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. **(Old No. 25.311)**

GEOL3121 Earth Environments 2 **S1 L3 T3**

Prerequisite: GEOL2121 (note: it is desirable that students taking this unit have also taken GEOL2331).

Stratigraphy. Stratigraphic classification. Biological and physical methods of correlation. Introduction to radiogenic methods of age determination: 14C, K/Ar, Rb/Sr, Nd/Sm, U/Th/Pb and fission track methods. Definition of international stratigraphic boundaries, stratotypes and reference points. Types of sedimentary basins and continental margins. The development of the Precambrian craton of Australia. The geological evolution of eastern Australia, particularly the late Paleozoic and Mesozoic history of the Tasman Mobile Belt. Intracratonic basins of western and southern Australia and the effects of the dispersal of Gondwanaland. Geological evolution of the northern margin of the Australian plate, particularly the Mesozoic to Recent of Papua-New Guinea. *Palaeontology.* Theories of biologic classification. Processes and theories of evolution. The origin and early history of life. Functional morphology. Practical application of palaeontology. *Field Mapping.* Geological report writing and cartography. *Field work* of up to seven days is a compulsory part of the subject. **(Old No. 25.312)**

GEOL3130 Mathematical Geology 2 **S1 L2 T1**

Prerequisite: GEOL2230.

Application of the mathematical techniques listed below to geological data processing and analysis. Analysis of variance. Introduction to matrix algebra. Regression analysis, trend surface analysis; time series analysis; Markov chain analysis. Introduction to nonparametric statistics. Introduction to multivariate statistics. *Practical work* based on the use of SPSS, BMDP and other library programs. **(Old No. 25.3162)**

GEOL3141 Mineral and Energy Resources 1 **S1 L3 T3**

Co-requisite: GEOL2211 or GEOL3111

Metallic Resources: Classification and origin of the ore deposits, geochemical processes, research methods. Orthomagmatic, hydrothermal, porphyry, volcanic-sedimentary, Mississippi Valley type, chromium, iron, managanese 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 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. *Field work* of up to three days is a compulsory part of the subject. **(Old No. 25.314)**

GEOL3211 Earth Materials 4 **S2 L3 T3**

Prerequisite: GEOL2211.

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 inerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. Industrial uses of clays and bauxite. *Advanced 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. *Advanced Metamorphic Petrology.* Facies series. Metamorphic reactions. Isograds. Mineral assemblages as geobarometers and geothermometers. Fluids in metamorphosism. Fabric. Relationships of deformations and recrystallization. Metamorphic petrology of Australia. Practical macroscopic and microscopic study of metamorphic rocks. *Field work* of up to six days is a compulsory part of the subject. **(Old No. 25.321)**

GEOL3241 Mineral and Energy Resources 2 **S2 L3 T3**

Prerequisite: GEOL2121 or GEOL8220.

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. *Sedimentary Basin Analysis.* Techniques of analysis and data presentation using information from outcrops, boreholes (including geophysical logs) and seismic sections. Construction and interpretation of structural isopachous and lithofacies maps. Seismic stratigraphy. Styles of semimentation within and structural development of basins in different tectonic regimes. Evolution of sedimentary basins. *Field work* of four days is a compulsory part of the subject. **(Old No. 25.324)**

GEOL3251 Engineering and Environmental Geology **S2 L4 T2**

Prerequisite: Nil

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 lay 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 of groundwater resources. Groundwater flow tests. Case studies from the Great Artesian Basin and the Murrumbidgee area. *Geomechanics.* 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. *Coastal Geology.* Properties of sedimentary populations. Sampling practice and analysis of measured data. Geological implications of sedmient parameters. Coastal environmental assessment. Shoreline processes. Geological evolution of the inner continental shelf. *Field work* of up to three days is a compulsory part of the subject. **(Old No. 25.325)**

GEOL3271 Structural Geology **S2 L1 T1**

Prerequesite: GEOL2211.

Advanced Structural Geology. Analysis of structural elements at the microscopic, mesoscopic and macroscopic scales. Detailed studies of the analysis of metamorphic terrains. eg Cooma Complex, Broken Hill. *Field work* of up to four days is a compulsory part of the subject. **(Old No. 25.3271)**

GEOL3281 Exploration Geochemistry **S2 L1 T1**

Prerequisites: GEOL3111 and GEOL3141.

Principles and techniques of soil drainage and rock geochemistry as applied to mineral exploration. **(Old No. 25.3281)**

GEOL3331 Exploration Geophysics **S1 L3 and S2 L1 T1**

Prerequisite: GEOL1201.

Physical properties of rocks and soils. Introduction to seismic, gravity, magnetic, electrical, electromagnetic and radiometric methods of geophysical exploration. Application of these methods in the search for mineral deposits, petroleum, coal and groundwater and in civil and mining engineering projects. Interpretation of geophysical data. *Field work* of up to three days is a compulsory part of the subject. **(Old No. 25.333)**

GEOL4111 Advanced Geological Techniques **S1 L T6**

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. **(Old No. 25.411)**

GEOL4121 Professional Practice **S1 L3 T3**

Prerequisites: GEOL3141, GEOL3240.

Project Management: Organization 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.

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.

Topics to be covered will include: the rights and obligations of consumers and manufacturers with specific applications from the food industry. Issues associated with the restructuring of

industries, public transport, port facilities etc. Government protection of manufacturing industries such as automobiles, clothing and chemicals and the impact of this on relationships with our trading partners. The resolution of conflicts of interest over landuse in national parks, wilderness and recreational areas and urban areas. Energy policies and their global implications. The impact of mining on society and the environment. The effects on society of the introduction of new technologies such as home based computer terminals and new materials such as semiconductors. The influence of cartels and the political importance of strategic materials. **(Old No. 25.412)**

GEOL4131 Special Topics in Applied Geology S1 L, T12

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. Details of these programs are available from the Head, Department of Applied Geology. The special Topics program would normally be related to the topic of the chosen Field Project and is designed to be a preparatiuon for a future career. Variation from the standard programs is allowed subject to approval from the Head of Department. **(Old No. 25.413)**

GEOL4203 Field Project S2

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. **(Old No. 25.420)**

Servicing Subjects

These are subjects taught within courses offered by other faculties.

GEOL4303 Geology Honours

Students with a double major in geology will follow the program set for Year 4 students in the Faculty of Applied Science course, 3000 Applied Geology. **(Old No. 25.435)**

GEOL5100 Geology for Civil and Environmental Engineers S1 L2 T1

An introduction to mineralogy, petrology, structural geology, stratigraphy and geomorphology. Weathering of rocks and development of soils. The role of the geologist in civil and environmental engineering. **(Old No. 25.5112)**

GEOL5110 Geology for Landscape Architecture

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. **(Old No. 25.5222)**

GEOL5211 Geology for Mining Engineers 1 F L1 T1

Outline of the main brances of geology and their application to Mining Engineering. Introduction to geomorphological processes and resulting landforms. Fundamentals of the atomic structure of minerals including major rockforming minerals and ore minerals, their crystal symmetry, their physical and chemical properties. *Igneous Rocks*, formation, texture, composition and classification of the more important igneous rocks. *Sedimentary Rocks*, processes of formation depositional environment, composition and classification. *Metamorphic Rocks*, metamorphic processes and metamorphic structures, classification and description of metamorphic rocks. Physical properties of rocks including porosity, permeability and capillarity. Weathering processes of rocks and minerals. Deformation of rocks and the resulting effects such as folds, faults, joints and foliation. An introduction to modern theories of tectonism. Integration of geological observations. *Practical Work.* Laboratory work consists of exercises related to the Lecture course: geological mapping includi ng structure contour problems. Study of minerals and rocks in hand specimens. *Field Tutorials.* Two field tutorials are conducted at which attendance is compulsory. Satisfactory reports must be submitted. Note: Total hours: 56. The subject is divided equally between lectures and laboratory work. Field Tutorial hours are additional. **(Old No. 25.520)**

GEOL5300 Physical Geology for Petroleum Engineers 1 S1 L1 T2

Introduction to earth science, the constitution of the earth, rock composition, rock types and processes of formation and deformation, organic evolution, geological time, fluids in rocks, presentation of geological data. **(Old No. 25.5331)**

GEOL5311 Geology for Mining Engineers 2 F L2 T2

Palaeontology and Stratigraphy: principles of stratigraphy; the use of fossils in stratigraphic correlation and bore logging. *Structural Geology*: elements of structural geology: stereographic projection and fracture analysis applied to mining operations. *Geology of Fuels:* origin and properties of coal, oil, oil shale and natural gas; stratigraphic and structural considerations in exploration and development of coal and petroleum deposits. *Hydrogelogy:* principles of hydrogeology: principles of hydrogeology; transmission of ground water in rocks and soils applied to mining operations. *Ore Deposits:* mineralogy of industrially important metallic and non-metallic minerals; theories of ore formation including secondary enrichment processes. *Exploration Procedures:* theories and application of exploration techniques in mineral and coalfield exploration including geological and geophysical methods. *Field Tutorial:* a geology field excursion is held at the end of Session 1, attendance is compulsory. **(Old No. 25.530)**

GEOL5320 Physical Geology for Petroleum Engineers 2 S2 L1 T2

Sedimentary petrology, sedimentary environments and facies, facies analysis, origins and formation of petroleum, exploration techniques, petroleum in Australia. **(Old No. 25.5332)**

GEOL5370 Structural Geology for Petroleum Engineers S2 L1 T2

Co-requisite: GEOL5300

Origin and properties of both regional and local geological structures and petroleum traps. Delineation of structures and petroleum traps by geophysical methods. **(Old No. 25.5302)**

GEOL6201 Marine Geology 1 **F L1 T2**

Prerequisites: GEOL1101 and GEOL1201.

Sedimentology. Flow regimes and bedding forms, sedimentary structures. Modern and ancient sedimentary environments of deposition, alluvial, nearshore, 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. *Global Geophysics.* Principles of gravity, geo-magnetism, palaeomagnetism, geothermy and seismology and their relation to shape, internal constitution, dynamic processes and major tectonic features of the earth. *Mineralogy and Petrology.* Igneous and sedimentary rock types of the ocean floor and their significance.

Field work of five days is a compulsory part of the subject. **(Old No. 25.621)**

GEOL6231 Coastal Monitoring Techniques **FL1T2**

Prerequisite: Nil

General principles of surveying. Optical and electronic methods of distance and elevation measuring. Coastal position fixing. Co-ordinates 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 esturine monitoring. **(Old No. 25.622)**

GEOL6310 Marine Mineral Deposits and Oceanic Minerals **S1 L1 T2**

Oceanic minerals and mineral deposits: Resources important to human civilization of a biological, fluid and mineral nature. Mining of ocean resources. Geological aspects of waste disposal and engineering works in the ocean. Tidal energy. **(Old No. 25.6341)**

GEOL6311 Marine Geology 2 **F L1 T2**

Prerequisite: GEOL6201.

Clay Mineralogy. 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. *Sedimentary Basin Analysis:* Techniques of analysis and data presentation using information from outcrops, boreholes (including wireline logs) and seismic sections. Construction and interpretation of structural, isopachous and lithofacies maps. Seismic stratigraphy. Styles of sedimentation within the structuring of basins in tensional, compressive and strik-slip tectonic regimes. Basin evolution. *Stratigraphy.* Ocean basin stratigraphy and the environmental and chronological utility of the principal groups of index fossils. Stratigraphical history and correlation of sedimentary rocks in the deep ocean basins and on continental shelves. Changes of sea level. The Quaternary history of the oceans. Reefs and carbonate sedimentation. Deep sea consolidated sediments. Field work not esceeding two days is a compulsory part of the subject. **(Old No. 25.631)**

GEOL6321 Coastal Environmental Assessment **FL1T2**

Prerequisite: Nil

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. **(Old No. 25.630)**

GEOL6330 Exploration and Seismic Methods **S2 L2 T1**

Geophysics of ocean basins and off-shore 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. **(Old No. 25.6342)**

GEOL7221 Surficial Materials and Processes **S2 L3 T2**

Prerequisite: GEOL2111

Clay Mineralogy. The structure and properties of the clay minerals groups including the kaolinities, illites, smecites, cholorites, mixed layered and fibrous clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. Industrial uses of clays and bauxite. *Sedimentary Petrology.* The influence and transportation, deposition and diagenisis on the composition, texture and structure of detrital sedimentary rocks. The non-clastic sedimentary rocks including phosphates, evaporites, ferruginous and silceous deposits. *Hydrology.* The hydrological cycle; confined and unconfined groundwater. Hydrological characteristics of rocks and their measurement. Pump tests. Aquifer boundaries. Exploration for groundwater development and monitoring of groundwater resourves. Groundwater flow tests. Case studies from the Great Artesian Basin and the Murrumbidgee area. **(Old No. 25.511)**

GEOL7321 Geology for Geomorphologists and Pedologists **S1 L1 T1 S2 L2 T2**

Prerequisites: GEOL2111, GEOL2211.

Clay Mineralogy. The structure and the properties of the clay groups, including the kaolinites, illities, 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. **(Old No. 25.510)**

GEOL8220 Sedimentology **S1 L1 T1**

Prerequisite: GEOL1201. Excluded: GEOL3121 Earth Environments 2

As for *Sedimentology* in GEOL3121 Earth Environments 1. **(Old No. 25.5212)**

GEOL8310 Stratigraphy **S1 L2**

Prerequisite: GEOL8220. Excluded: GEOL3121

As for *Stratigraphy*, in GEOL3121 Earth Environments 2. **(Old No. 25.5313)**

GEOL8320 Gravity and Magnetic Methods **S1 L2 T1**

Prerequisites: PHYS1002 and MATH1032. It is desirable that students taking this unit have a background to geology.

Fundamental principles. Field procedures and instruments. Reduction of field data. Regionals and residuals. Effects of sources of simple geometrical shapes and generalized two and three-dimensional distributions. Applications. Field work of one day is a compulsory part of the subject. **(Old No. 25.9311)**

GEOL8330 Seismic Methods **S1 L2 T1**

Prerequisites: PHYS1002 and MATH1032. It is desirable that students taking this unit have a background in geology.

Seismic waves. Physical/engineering properties of geological materials. Ray theory is seismic refraction and reflection methods. Instrumentation. Data acquisition and processing. Depth and velocity analysis. Geophysical and geological interpretation. Case history studies. *Field work* of one day is a compulsory part of the subject. **(Old No. 25.9312)**

GEOL8340 Electrical Methods **S1 L2 T1**

Prerequisites: PHYS1002 and MATH1032. It is desirable that students taking this unit have a background in geology.

Introductory theory and field practice of resistivity, self-potential, induced polarization and airborne and ground electromagnetic methods. Geological interpretation of field data. Geophysical logging. Field work of one day is a compulsory part of the subject. **(Old No. 25.9313)**

GEOL8350 Geological Applications **S1 L1 T1**

Prerequisite: GEOL1201.

A subject of ten weeks' duration. *Structural Geology:* Elements of structural geology, sterographic 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. *Field work* of one day is a compulsory part of the subject. **(Old No. 25.9314)**

GEOL8360 Geophysical and Geological Applications **S2 L1 T2**

Prerequisite: GEOL1201. Excluded: GEOL6330.

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. Available only in program 2503. **(Old No. 25.9321)**

GEOL9110 Hydro and Environmental Geology S2 L3 T1

Prerequisite: GEOL5100

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. Field work of up to two days is a compulsory part of this subject.

GEOL9120 Groundwater Contaminant Transport **S1 L3 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 groundwaters 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 borehold 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 borefield management, saltwater intrusion, mine dewatering, waste disposal and contaminant transport.

Graduate Study

Department of Mining Engineering

Generally these subjects are of three hours' duration per week or multiples of that time.

MINE0014 Exploration Drilling

Drilling equipment and technology. Deep boring. Selection of drilling methods, drill hole surveys. Development and exploitation of mineral resources. Exercises on mine planning. **(Old No. 7.001G)**

MINE1114 Mining Engineering

1. Surveying methods to quantify mineral resources. Mine development. Explosives. Shaft sinking, tunnelling, excavation methods. **2.** Advanced mining systems, parameters for applicability and efficiency of mining methods, waste disposal. Non-entry methods, in situ mining. Off-shore mining methods. Rock mechanics, mechanical behaviour of rocks. The Mining Acts. **(Old No. 7.111F)**

MINE1224 Mining Engineering Technology

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. **(Old No. 7.122G)**

MINE1324 Mining Engineering Laboratory

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. **(Old No. 7.132G)**

MINE1514 Ground Control and Excavation Engineering

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.** Rock-breaking and drilling methods, penetrability and workability of rocks; fracturing. Nature, occurrence and prediction of rockbursts. Mechanics of crack propagation and subsidence. **(Old No. 7.151G)**

MINE1524 Mining Conservation

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, socio-economic aspects of mining, rehabilitation costs, government regulations. Examination and evaluation of a current operation. **(Old No. 7.152G)**

MINE1534 Environmental Conditions in Mines

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. **(Old No. 7.153G)**

MINE1544 Rock Excavation and Transportation

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. **(Old No. 7.154G)**

MINE3114 Mineral Beneficiation

Prerequisite: MINE7341 or equivalent

Processing economics: mineral processing and its integration with mining, metallurgical and chemical operations. Principles of raosting, 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. **(Old No. 7.311G)**

MINE3224 Mineral Beneficiation Technology

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 flow-sheets. 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. **(Old No. 7.322G)**

MINE3324 Mineral Engineering Laboratory

Prerequisite: MINE3114 or equivalent.

Laboratory investigations may be selected from the following according to availability and specialization: metalliferous ore concentration; coal preparation; beneficiation of non-metallics; processing of mineral fluids. **(Old No. 7.332G)**

MINE3514 Mineral Beneficiation

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. **(Old No. 7.351G)**

MINE3614 Minerals Engineering 1 **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-, Surfaceand 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. **(Old No. 7.361G)**

MINE3624 Minerals Engineering 2 **S1 L4 T4**

1. *Comminution.* Fracture. Liberation. Energy-size relationships. Grindability. Conventional comminution equipment. Feed and product characteristics. Open and closed circuit operation. Vibratory and fluid energy mills. **2.** *Screening and classification.* Screening as a process of chance. Screen loading. Factors affecting screen capacities. Types of screen. Probability screens. Optical imaging. Hydraulic, mechanical and cyclone classifiers. **3.** *Physical concentration processes.* Gravity concentration. Jigs, heavy media and flowing films. Electronic and optical sorting. Electrical and magnetic separators. **4.** *Chemical concentration processes.* Leaching. Solvent extraction and ion exchange. Cementation. Cyanidation and amalgamation. **5.** *Flotation.* Collectors, activators, depressants, modifiers, frothers. Conventional and novel cells. Flotation kinetics. Entrainment. Soluble salt flotation. Reverse flotation. Agglomeration and carrier flotation. Selective flocculation and agglomeration. **6.** *Liquid-solid separation and product disposal. Flocculation. Thickening. Filtration. Drainage. Dewatering by screens and cyclones. Centrifuging. Dryers. Tailings dams. Tailing utilization including mine fill, reclamation. Pollution control.* **(Old No. 7.362G)**

MINE3634 Minerals Engineering Laboratory **S1 T3**

A series of laboratory investigations relating to material covered in subjects MINE3614 and MINE3624 **(Old No. 7.363G)**

MINE3644 Minerals Engineering 3 **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. **(Old No. 7.364G)**

MINE3654 Minerals Engineering Project **S2 T10**

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. **(Old No. 7.365G)**

MINE4424 Mineral Industry Analysis **S2 L2**

Aspects of micro- and macro-economics. Type of companies, private, public, no-liability, 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, improvization. Grade control, estimation of cut-off grades. Includes advanced work in the technical and economic analysis of mining or mineral operators. Cases are selected for examination and analysis; critical review. **(Old No. 7.442G)**

MINE4055 Numerical Methods in Geomechanics S1 3

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. **(Old No. 7.405X)**

MINE4155 Stability of Slopes S2 3

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, probabalistic 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. **(Old No. 7.415X)**

MINE4555 Mining Geomechanics Project F 6

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. **(Old No. 7.455X)**

MINE5155 Rock Mechanics Measurements S1 3

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. **(Old No. 7.515X)**

MINE5255 Strata Control Engineering S2 3

Dislocations, stress changes and energy changes in the rock mass around underground excavations. Design of self-supporting, artificially supported and caved underground excavations. Introduction to boundary element methods of stress analysis. Prediction and control of rockbursts and instantaneous outbursts in coal. Analogue modelling of pillar mining. Rock mechanics of longwalls. **(Old No. 7.525X)**

MINE5355 Mine Fill Technology S2 3

Fill properties and their assessment. Fill preparation, placement and dewatering. Field sampling and in situ testing. Mining methods employing fill. Pozzolanic fills. Dry fills and rock fills. Economic aspects of fill practice. Soil and rock mechanics aspects. Environmental aspects. Specific fill practice in mining coal and uranium. **(Old No. 7.535X)**

MINE5455 Advanced Rock Cutting Technology S2 3

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. **(Old No. 7.545X)**

MINE5555 Blasting Technology S2 3

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. **(Old No. 7.555X)**

MINE5655 Rock Slope Stability F 2

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. **(Old No. 7.565X)**

MINE5755 Subsidence Engineering F 2

Trough subsidence resulting from the extraction of bedded mineral deposits. Parameters influencing subsidence. Subsidencerelated phenomena causing damage to structures at or below the surface. Measurement and empirical prediction. Theories and modelling of subsidence. Control of subsidence. **(Old No. 7.575X)**

MINE9174 Fire and Explosion 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. **(Old No. 7.917G)**

MINE9364 Equilibrium Concepts in Water Systems

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. **(Old No. 7.936G)**

MINE9374 Hydrogeochemistry S1 L1.5 T1.5 C3

Chemical composition of natural and contaminated groundwater, inorganic and organic chemical principles. Application of chemical thermodynamics in groundwater

systems; data sources. Development of Eh pH, activity and other diagrams to assess system stabilities and mineral dissolution and precipitation. Non-equilibrium approaches. Chemical classification of groundwaters and hydrochemical facies in aquifers. Geochemical evolution of groundwater along flow paths in a variety of porous and fractured rocks for saturated and unsaturated zones. Application of stable and radioactive isotopes. Computer models to evaluate chemical patterns. Case studies of significant groundwater basins; Great Artesian Basin. 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 insitu chemical parameter measurement, sampling, laboratory analysis, laboratory and field experiments for determination of hydrochemical parameters, adsorption, desorption, Kd, dispersivity. **(Old No. 7.937G)**

MINE9415 Advanced Rock Mechanics S1 3

Field measurement of rock mass properties. Controlled post-failure strength and deformation proerties of rock. Data collection and analysis of rock mass and support response. In situ stress measurement. Prediction of pre and post-mining rock stresses and deformations. Monitoring rock movement and stress change in underground and surface rock excavations. Seismic techniques in rock mechanics. Dislocations, stress changes and energy changes in the rock mass around underground excavations. **(Old No. 7.941X)**

Department of Applied Geology

GEOL9010 Hydrogeology S1 L1.5 T1.5 C3

GEOL9310 Hydrogeology S1 X C3

Surface and sub-surface methods of geological and geophysical investigation; ground water exploration of confined and unconfined aquifiers. Geological and hydraulic characteristics of rocks; aquifer boundaries, groundwater storage and quality. Hydraulics of wells. Hydrogeological systems analysis, including computer methods, mapping techniques and groundwater resources evaluation. Hydrogeology of arid and semi-arid zones. Case history studies of groundwater fields. **(Old No. 25.702G)**

GEOL9020 Geopollution Management S1 L1 T1 C3

GEOL9320 Geopollution Management S1 X C3

Material properties and hydrodynamic factors influencing surface and subsurface flow of pollutants in rocks and soils. Dispersion theory and modelling for pollutants in aquifers. Water quality and the problems of standards. Use of field instruments for quality determination. Geological and technological factors in waste disposal: domestic and industrial wastes, including the Rocky Mountain Arsenal Well case study, deep well injection methods. Management of radioactive wastes, waste disposal problems in limestone areas. Case studies of aquifer pollution and practical measures for preventing pollution. Rational planning of water resources for industrial and domestic use. **(Old No. 25.707X)**

GEOL9030 Geological Engineering S1 L1.5 T1.5 C3

Geomechanical properties of intact rock. Geomechanical properties of discontinuities and rock masses. Weathering processes and geotechnical consequences. Engineering classidicaiton of rock masses. Excavation - rippability, mechanical excavation of tunnels, surface and tunnel blasting. Rock support for shallow underground structures. Dam engineering, dam size geology, embankment zoning, foundation treatment and grouting, materials selection and specificaiton, dispersive soils and filter design. Foundations on rock, buildings, temporary supprt of open excavations. **(Old No. 25.726G)**

GEOL9040 Fundamentals of Geomechanics S1 L1.5 T1.5 C3

GEOL9340 Fundamentals of Geomechanics S2 X C3

This subject will not be offered in 1991.

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. **(Old No. 25.727G)**

GEOL9060 Environmental Geology S1 L1.5 T1.5 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 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. **(Old No. 25.704G)**

GEOL9070 Engineering Geophysics S1 L2 T1 C3

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 geoelectric theory, resistivity sounding and profiling with applications to determination to bedrock depth, location of water table, clay filled dykes, shear zones. Magnetic, electro-magnetic 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. Field tutorials: Short field tutorials are included. **(Old No. 25.705G)**

GEOL9080 Groundwater Geophysics S1 L1.5 T1.5 C3

Fundamentals and theory of the gravity, magnetic, electrical, electro magnetic and seismic geophysical methods. Relationships between geophysical and hydrogeological properties of earth materials. An introduction to geophysical well logging. Applications of geophysics to regional and detailed groundwater exploration and development, including surface and airborne techniques. In particular: location of water table, stratigraphic detail, determination of bedrock depth, water quality, porosity and pollution plumes, salinity mapping, saltwater-fresh water interface, fracture and cavity detection. **(Old No. 25.716G)**

GEOL9090 Computing for Groundwater Specialists S1 L1.5 T1.5 C0

Introduction to FORTRAN programming, mainframe, microcomputer operation systems, databases, spreadsheets, statistical and graphical packages with applications relating to groundwater processes. **(Old No. 25.717G)**

GEOL9100 Remote Sensing of Groundwater Resources S3 L1.5 T1.5 C3

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infra-red remote sensing techniques; side-looking airborne radar; theory and applications of Landsat imagery; 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. **(Old No. 25.718G)**

GEOL9424 Groundwater Research Project S2 C18

Research investigation consisting of one or more of; modelling, laboratory experiments, field work related to hydrogeology and groundwater management. **(Old No. 25.719G)**

GEOL9434 Groundwater Project S2 C12

Study of similar content to GEOL9424 but at a smaller scale. **(Old No. 25.720G)**

GEOL9444 Project In Engineering Geology C6

Study of similiar content to GEOL9464 but at a much smaller scale. **(Old No. 25.730G)**

GEOL9454 Project In Engineering Geology C9

Study of similiar content to GEOL9464 but at a smaller scale. **(Old No. 25.731G)**

GEOL9464 Project In Engineering Geology C15

The project is a research investigation consisting of field and laboratory work in any of the disciplines. Engineering Geology, Environmental Geology, Hydrogeology. **(Old No. 25.732G)**

GEOL0010 Seminar S1* T2

A weekly seminar to present and discuss student papers on exploration topics: speakers from industry are invited to attend and present papers from time to time. **(Old No. 25.800G)**

GEOL0020 Geology in Exploration 1 S1* L4

The development of conceptual models in mineral exploration and formulation of exploration programs. Consideration of significant guides to ore including structure, lithology, alteration and gossans. **(Old No. 25.801G)**

GEOL0030 General Introduction to Exploration Geophysics S1* L3

A basic introduction to the theory and practice of exploration geophysics, including treatment of applications and limitations of the main methods of seismic, electric, electro-magnetic, gravity, magnetic and radiometric methods to geological problems in hydrocarbon, coal, ground water, mineral and engineering exploration. Treatment includes fundamental aspects of the method and case histories illustrating applications areas. Field tutorial survey camp: An integrated, geological, geophysical and geochemical field tutorial survey camp of seven days' duration is an integral part of this subject. **(Old No. 25.802G)**

GEOL0040 Introduction to Exploration Geochemistry S1* L3

Basic principles of exploration geochemistry and the role of exploration geochemistry in the generalized exploration sequence. Principles and problems of anomaly recognition. Examples of main applications. **(Old No. 25.803G)**

GEOL0050 Introduction to Data Processing and Interpretation S1* L3

FORTRAN and computer programming; use of terminal facilities. Basic data storage and retrieval. Simple interpretative procedures for exploration data. **(Old No. 25.804G)**

GEOL0060 Resource Economics 1 S1* L1

Interdependence of political, economic and technical factors in mineral resource supplies. Examination of the main factors in reserves and resources estimation. **(Old No. 25.805G)**

GEOL0070 Exploration Geophysics S1* L6

An introduction to the theory and practice of all geophysical methods in exploration for energy, minerals, groundwater and engineering applications. These will include seismic reflections, seismic refraction, electrical, electro-magnetic, magnetic, gravity and radiometric methods of exploration, including the planning and conduct of field surveys for general and particular applications, and the theory and practice of the interpretation of geophysical results in terms of geological problems, conditions and occurrences. **(Old No. 25.807G)**

GEOL0080 Exploration Project **S1* T6**

Interpretation of exploration case-history data designed to familiarize students with the type of information normally required by exploration companies. **(Old No. 25.808G)**

GEOL0090 Advanced Geology in Exploration **S1' L4**

Definition of the geological environment and search techniques for major categories of mineral deposits including porphyry coppers, carbonateand shale-hosted lead-zinc ores, volcanogenic massive sulphide ores, vein and sandstone uranium. Geological aspects of reserve estimation. Exploration case histories. **(Old No. 25.811G)**

GEOL0100 Resource Economics 2 **S1' L2**

Distribution, production, consumption and trade in minerals. Supply adequacy and resource assessments and projected requirements. Review of the Australian minerals industry in a global context. **(Old No. 25.815G)**

GEOL0110 Geological Remote Sensing **S1' L4**

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infra-red remote sensing techniques; side looking airborne radar; theory and applications of Landsat imagery; 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. **(Old No. 25.816G)**

GEOL0120 Mining Law and Exploration Management **S1' L1**

Mining law in Australia with special reference to land tenure and lease acquisition; organization and management of exploration programs. **(Old No. 25.817G)**

GEOL0130 Exploration Project **S1' T6**

Design and costing of exploration program by students. This may be based on simulated conditions or actual situations. **(Old No. 25.818G)**

GEOL0144 Field-Laboratory Project **S2**

An individual exploration project that requires the student to acquire field and laboratory data on geological, geochemical and geophysical aspects of an actual exploration problem. As far as possible the project should be designed in consultation with the exploration industry. A report is required. **(Old No. 25.819G)**

GEOL0150 Geology in Exploration 2 **S1' L2**

Specialized search techniques for selected types of metallic ores, with appropriate case histories. **(Old No. 25.821G)**

GEOL0160 Advanced Exploration Geochemistry **S1' L2 T6**

Detailed consideration of the main techniques with emphasis on soil, drainage and rock surveys. All applications and problems will be examined on the basis of case-histories of actual surveys. Special consideration is given to problems of applications under Australian conditions. **(Old No. 25.823G)**

GEOL0170 Advanced Data Processing and Interpretation **S1' L2 T2**

Advanced concepts of data storage and retrieval; problems of display of geochemical data; multi-variate statistical data interpretation. Students are encouraged to supply their own data sets for processing. **(Old No. 25.824G)**

GEOL0180 Laboratory Methods **S1' L1 T3**

Instruction in the main techniques o sample preparation and instrumental analysis appropriate to exploration geochemistry. Practical experience with AAS and XRF. Students are encouraged to supply their own samples. **(Old No. 25.827G)**

GEOL0190 Exploration Project **S1' T6**

Interpretation of exploration data from geochemical surveys; this may be based on data from actual surveys, or data generated by the students themselves. **(Old No. 25.828G)**

GEOL0204 Field-Laboratory Project **S2**

An individual research project designed to contribute to the solution of a practical exploration problem; as far as possible the project should be chosen in consultation with the exploration industry to ensure relevancy to current exploration problems. In general the project involves collection of field data and samples, chemical analysis of samples, and interpretation of the results. A report is required. **(Old No. 25.829G)**

GEOL0210 Geological Interpretation **S1' T2**

The geological interpretation of geophysical data and geophysical models in seismic, electrical, electromagnetic, gravity and magnetic methods, including selected case studies from petroleum, coal, mineral and engineering exploration. **(Old No. 25.831G)**

GEOL0220 Advanced Exploration Geophysics **S1' L16**

An extension and advanced treatment of the subject matter in 25.807G, in the theory and practice of field and interpretational procedures in all methods and aspects of exploration geophysics, including instrumentation, manual and electronic data processing and interpretation. Specific application areas for prominent geophysical exploration techniques in the solution of relevant geological problems are treated in detail in both field and theoretical aspects of the methods. **(Old No. 25.832G)**

GEOL0234 Field-Laboratory Project **S2**

Exploration geophysical project on one or more topics of relevance in energy, water, mineral or engineering exploration. Includes tutorial sessions and seminars on relevant topics of geophysical geological geochemical exploration. **(Old No. 25.839G)**

GEOL0240 Seminar **S1' T2**

A weekly joint seminar of Mineral Exploration, Exploration Geochemistry, and Exploration Geophysics students who present papers on aspects of their own particular specialization. Outside speakers from industry and government organizations are invited to participate in the seminars from time to time. **(Old No. 25.840G)**

GEOL0004 Special Program Applied Geology
For programs 8020, 8021, 8091, 8092 and 8093

GEOL0005 Research Thesis Applied Geology - Full-time
For programs 1000 and 2000

GEOL0006 Research Thesis Applied Geology - Part-time
For programs 1000 and 2000

**Equivalent contact hours, but also including fieldwork out of session.
*Weeks 1-7 only.
'Weeks 8-14 only.

Servicing Subject Descriptions

Undergraduate Study

Accounting

ACCT1501 Accounting and Financial Management 1A **S1 or S2 L2 T2.5**

Prerequisite: Nil.

This is the first unit in a sequence of subject dealing with aspects of the practice of financial reporting, and reviewing the analytical and investigative tools and processes used within the discipline of accounting. 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) culminating in the preparation of financial reportrs. 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. **(Old No. 14.501)**

ACCT1511 Accounting and Financial Management 1B **S1 or S2 L2 T2.5**

Prerequisite: ACCT1501.

The second unit in a sequence of financial accounting subjects including 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. Overview of accounting for investments. Preparation of simple funds statement. **(Old No. 14.511)**

ACCT2522 Accounting and Financial Management 2A **S1 L2 T2.5**

Prerequisites: ACCT1511. Excluded: ACCT2532.

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 organisational functioning, with emphasis on both manufacturing and service organisations. Involves the use of spreadsheet modelling and the use of personal computer. **(Old No. 14.522)**

ACCT2542 Accounting and Financial Management 2B **S2 L2 T2.5**

Prerequisite: ACCT1511. Excluded: ACCT2552.

The third financial reporting unit after 1501 and 1511 with a consideration of more complicated transactions and events as well as the accounting problems in certain specific industries. 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. Application of computer technology to financial accounting problems. **(Old No. 14.542)**

Biochemistry

BIOC2312 Principles of Biochemistry and Molecular Biology **F L2.5 T3.5**

Prerequisites: BIOS1011 and BIOS1021, CHEM1101 and CHEM1201 or CHEM1002. Excluded: CHEM2929.

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. **(Old No. 41.101)**

Biological Science

BIOS1011 Biology A **S1 L2 T4**

Prerequisite:	*HSC Exam Score Range Required*
2 unit Science (Physics) or	*53-100*
2 unit Science (Chemistry) or	*53-100*
2 unit Science (Geology) or	*53-100*
2 unit Science (Biology) or	*53-100*
3 unit Science or	*90-150*
4 unit Science	*1-50*

Basic cell structure; membranes, organelles, prokaryotic and eukaryotic cells; cellular locomotion; basic biological molecules; enzymes; structure and metabolic roles, cellular compartmentalization and enzyme function; diffusion, osmosis and active transport; theory of inheritance, linkage, mutation, information transfer and protein synthesis. **(Old No. 17.031)**

Requirements for Practical Work

Equipment required for practical work is set out in the Course Guide, available during enrolment time at the First Year Registration Centre (Physics Building). Students must purchase this prior to the first week of session.

BIOS1021 Biology B **S2 L2 T4**

Prerequisite: BIOS1011 (however, students without this prerequisite may seek the permission of the Co-ordinator of First Year Biology to enrol).

Excluded BIOS021.

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. **(Old No. 17.041)**

BIOS2021 Introductory Genetics **S2 L2 T4**

Prerequisite: CHEM1201 or CHEM1002, BIOS1011, BIOS1021, Co-requisite: BIOC2312. Excluded WOOL3803, 45.601

Structure, function and organization of DNA in prokaryotyes and eukaryotes. Genetic bases of life cycles in prokaryotes and eukaryotes. Genetic aspects of development. Gene control. Genetic engineering. Mutation, gene interaction and linkage analysis in prokaryotes and eukaryotes. Binomial Square Law and extensions. Effects of population size on levels of genetic variation. Selection in natural populations. Molecular evolutation and levels of selection. Cytogenetics, gene mapping, levels of variation and selection in human populations. Recombination in prokaryotes and eukaryotes.

Students are not admitted to Level III Biological Science units without special permission of the Head of School unless Chemistry CHEM1002 or both CHEM1101 and CHEM1201 have been completed. **(Old No. 17.601)**

BIOS2031 Biology of Invertebrates **S2 L2 T4**

Prerequisite: BIOS1011 and BIOS1021. Excluded: 45.201.

A comparative study of morphology, taxonomy and functional biology of invertebrate animals. Emphasis is placed on the major groups (Anthropods and Molluscs) and on marine forms. Practical classes and a compulsory field camp illustrate the lecture material. **(Old No. 17.722)**

BIOS2051 Flowering Plants **S2 L2 T4**

Prerequisites: BIOS1011 and BIOS1021. Excluded 43.111, 45.111.

This covers basic aspects of plant biology and provides practical skills required in level III units. It is essential for students intending to specialise in the plant sciences. The course follows the development of plants from seedling stage to maturity, examining the structural and environmental controls, and the close relationship between structure and function in major plant systems. The following topics are dealt with in detail: the properties of plant cells and their walls in relation to growth; differentiation and how cells are organised into different tissues; transport systems and the movement of water and photosynthetic products; seed structure, the physiology of germination and its regulation by internal and external factors; primary and secondary growth and its regulation by plant hormones; shoot systems; leaf development; aborescence; adaptation to particular environments; root systems; mineral acquisition and water unpake; root growth and development; interactions of roots with microorganisms and the impact of symbiotic associations such as mycorrhizas on root structure and physiology; evolution of the land plants; the significance of having an enclosed carpel and the evolution of the gynoecium. Practial work provides: basic skills in plant anatomy and light microscopy; an introduction to the character states of flowering plant families in the Sydney region; how to use a key to identify a plant; growth and mineral nutrition, including collection of numerical data and a statistical approach to data handling; inoculation of plants with microorganisms; an integrated approach to salt secretion in mangroves **(Old No. 17.702)**

BIOS2061 Vertebrate Zoology **S1 L3 T3**

Prerequisite: BIOS1011, BIOS1021. Excluded: 45.301.

A 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 the lecture course. Field excursions as arranged. **(Old No. 17.732)**

BIOS3061 Environmental Botany **S1 L2 T4**

Prerequisites: BIOS1011 and BIOS1021. Excluded: 43.142.

The soil and atmospheric environments in which plants live and a study of the interaction of plants with their environment. Energy and mass transfer. **(Old No. 17.713)**

BIOS3111 Population and Community Ecology **S1 L2 T4**

Prerequisite: BIOS1021 and MATH1032 or both MATH1011 and MATH1021.
Excluded: 45.152.

Examination of the dynamics of one, two or more interacting populations. Systems analysis and simulation in ecology. Theoretical and mathematical analysis of the dynamics and stability of ecosystems. Topics in the optimal management of renewable resources. Unifying concepts in ecology. **(Old No. 17.733)**

Biotechnology

Biotechnology is a Department within the School of Applied Bioscience.

BIOT3011 Biotechnology A **S1 L3 T3**

Prerequisites: BIOS2312 and MICR2018

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 micro-organisms, laboratory-scale fermenter operation, microbial enzyme isolation, visits to industrial fermentation plants and industrial seminars. **(Old No. 42.102A)**

BIOT3021 Biotechnology B **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 teaching 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. **(Old No. 42.102B)**

BIOT3031 Microbial Genetics **S1 L2 T4**

Prerequisite: BIOS2011, BIOS2021, BIOC2312, MICR2011. Excluded: MICR3021.

This unit is suitable for students majoring in Microbiology, Biochemistry, Biotechnology or Genetics. It deals with major aspects of the genetics of bacteriophage, bacteria and yeast. Topics include plasmids and transposible genetic elements, gene transfer, mutagenesis and DNA repair, mutants, bacteriophage genetics, gene cloning (vectors, recombinant DNA techniques) and genetics of nitrogen fixation. **(Old No. 42.102C)**

BIOT3100 Fermentation Processes **S2 T2**

Factors governing the use of micro-organisms in industrial processes, including the selection, maintenance and improvement of micro-organisms, 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. **(Old No. 42.114)**

BIOT4073/BIOT4083 Biotechnology (Honours)

Advanced formal training in selected areas of biotechnology and participation in one of the school's research projects. **(Old No. 42.103)**

BIOT4093 Biological Process Engineering **F L2 T4**

Prerequisite: MICR2201

Structure of Metabolism: Growth of an undifferentiated organism as a physico-chemical 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. Macro-molecule production. Coordination and control of cellular processes. *Industrial Bio-processes:* A review of bio-process industries. The selection, screening and maintenance of commercial cultures. The optimization of bio-processes. 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. (Old No. 42.105)

Chemistry

CHEM1002 Chemistry 1 **F L3T3**

HSC Exam Score	*Range required*
Prerequisites 2 unit Mathematics or	*55-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100*
and	
2 unit Chemistry or	*53-100*
3 unit Science or	*90-150*
4 unit Science or	*1-50*
2 unit Physics	*53-100*

Stoichiometry and solution stoichiometry. Atomic and molecular structure. Electron configurations and the periodic table. Types of chemical bonds, electronegativity. States of matter, changes of state, phase diagrams, gases, liquids, solids, solutions. Chemical thermodynamics, enthalpy, entropy, free energy. Chemical equilibrium, equilibrium constants, quantitative calculations applied to acid-base and solubility equilibria, buffers, titrations, chemical analysis. Oxidation and reduction reactions, electrode potentials. Chemical kinetics. Molecular structure, valence bond theory, hybridization of orbitals, common geometries. Periodicity of physical and chemical properties of common representative elements and compounds. Chemistry of carbon compounds, stereoisomerism; alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids and derivatives, amines. Polymers. (Old No. 2.241)

CHEM1101 Chemistry 1A **S1 L3T3**

HSC Exam Score	*Range required*
Prerequisites 2 unit Mathematics or	*55-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100*
and	
2 unit Chemistry or	*53-100*
3 unit Science or	*90-150*
4 unit Science or	*1-50*
2 unit Physics	*53-100*

Stoichiometry and solution stoichiometry. Atomic and molecular structure. Electron configurations and the periodic table. Types of chemical bonds, electronegativity. States of matter, changes of state, phase diagrams, gases, liquids, solids, solutions. Chemical thermodynamics, enthalpy, entropy, free energy. Chemical equilibrium, equilibrium constants, quantitative calculations applied to acid-base and solubility equilibria, buffers, titrations, chemical analysis. Oxidation and reduction reactions, electrode potentials. Chemical kinetics. **(Old No. 2.221)**

CHEM1201 Chemistry 1B **S2 L3T3**

Prerequisites CHEM1101 Chemistry 1A

Molecular structure, valence bond theory, hybridization of orbitals, common geometries. Periodicity of physical and chemical properties of common representative elements and compounds. Chemistry of carbon compounds, stereoisomerism; alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids and derivatives, amines. Polymers.

Note: The two subjects CHEM1101 and CHEM1201, taken sequentially, are equivalent to CHEM1002. **(Old No. 2.231)**

CHEM1302 Introductory Chemistry **F L3T3**

HSC Exam Score	*Range required*
Prerequisites 2 unit Mathematics or	*55-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100*

Stoichiometry and solution stoichiometry. Atomic and molecular structure. States of matter, changes of state, phase diagrams, gases, liquids, solids, solutions. Chemical thermodynamics, enthalpy, entropy, free energy. Oxidation and reduction reactions, electrode potentials. Chemical kinetics. Electron configurations and the periodic table. Types of chemical bonds, electronegativity. Molecular structure, valence bond theory, hybridization of orbitals, common geometries. Chemical equilibrium, equilibrium constants, quantitative calculations applied to acid-base and solubility equilibria, buffers, titrations, chemical analysis. Periodicity of physical and chemical properties of common representative elements and compounds. Chemistry of carbon compounds, stereoisomerism; alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids and derivatives, amines. Polymers. **(Old No. 2..271)**

Note: CHEM1002 is the normal prerequisite for Level II Chemistry. However, students who perform very well in CHEM1302 will be permitted to continue on to Level II Chemistry with the permission of the Head of School of Chemistry.

CHEM1401 Introductory Chemistry A **S1 L3T3**

HSC Exam Score	*Range required*
Prerequisites 2 unit Mathematics or	*55-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100*

Stoichiometry and solution stoichiometry. Atomic and molecular structure. States of matter, changes of state, phase diagrams, gases, liquids, solids, solutions. Chemical thermodynamics, enthalpy, entropy, free energy. Oxidation and reduction reactions, electrode potentials. Chemical kinetics. **(Old No. 2.251)**

CHEM1501 Introductory Chemistry B **S2 L3T3**

HSC Exam Score *Range required*

Prerequisites CHEM1401 Introductory Chemistry A or

2 unit Mathematics or	*55-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100*
and	
2 unit Chemistry or	*53-100*
3 unit Science or	*90-150*
4 unit Science or	*1-50*
2 unit Physics	*53-100*

Electron configurations and the periodic table. Types of chemical bonds, electronegativity. Molecular structure, valence bond theory, hybridization of orbitals, common geometries. Chemical equilibrium, equilibrium constants, quantitative calculations applied to acid-base and solubility equilibria, buffers, titrations, chemical analysis. Periodicity of physical and chemical properties of common representative elements and compounds. Chemistry of carbon compounds, stereoisomerism; alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids and derivatives, amines. Polymers. **(Old No. 2.261)**

Note: The two subjects CHEM1401 and CHEM1501, taken sequentially, are equivalent to CHEM1302.

CHEM2011 Physical Chemistry **S1 or S2 L3 T3**

Prerequisites: CHEM1002 or CHEM1101 and CHEM1201 and MATH1042, or MATH1032, or MATH1011 and MATH1021. Excluded 2.002A

Thermodynamics: first, second and third laws of thermodynamics; statistical mechanical treatment of thermodynamic properties; applications of thermodynamics: chemical equilibria, phase equilibria, solutions of nonelectrolytes and electrolytes, electrochemical cells. Kinetics: order and molecularity; effect of temperature on reaction rates: elementary reaction rate theory. Surface chemistry and colloids: adsorption, properties of dispersions; macromolecules and association colloids. **(Old No. 2.102A)**

CHEM2021 Organic Chemistry **F or S2 L3 T3**

Prerequisite: CHEM1002 or CHEM1201. Excluded 2.002B

Discussion of the major types of organic reaction mechanisms eg addition, substitution, elimination, free-radical, molecular rearrangement within context of important functional groups eg aliphatic hydrocarbons, monocyclic aromatic hydrocarbons, halides, organometallic compounds, alcohols, phenols, aldehydes, ketones, ethers, carboxylic acids and their derivatives, nitro compounds, amines and sulfonic acids. Introduction to application of spectroscopic methods to structure determination. **(Old No. 2.102B)**

CHEM2031 Inorganic Chemistry and Structure **S1 or S2 L3 T3**

Prerequisites: CHEM1002 and CHEM1101 and CHEM1201. Excluded 2.042C

Fundamentals of spectroscopy as experimental basis for theories of electronic structures of atoms and molecules. Concepts and consequences of quantum theory. Molecular orbitals. Ligand field theory, magnetochemistry. Geometrical structure and chemical bonding, molecular and non-molecular structures, molecular symmetry, ionic covalent and metallic bonds. Occurrence, preparation, properties and reactions of compounds of the p-block elements, of transition metals and of post-transition metals. Principles of co-ordination chemistry. Thermodynamics applied to inorganic systems in solid and solution phases. **(Old No. 2.102C)**

CHEM2041 Chemical and Spectroscopic Analysis **S1 or S2 L3 T3**

Prerequisites: CHEM1002 or both CHEM1101 and CHEM1201 and MATH1042, or MATH1032, or MATH1011 and MATH1021. Excluded 2.002D and 2.003H

General procedures in analytical science, accuracy, propagation of errors, precision. Analytical reaction chemistry, titrimetric, and gravimetric, analysis. Solvent extraction. Electroanalytical methods. Chromatography. Instrumental aspects of all major spectroscopic methods. Optical spectroscopy, nuclear magnetic and electron spin resonances, mass spectrometry. Sample handling.**(Old No. 2.102D)**

CHEM2828 Organic and Inorganic Chemistry for Chemical Engineers **F L2**

Prerequisites: CHEM1002 or both CHEM1101 and CHEM1201.

Discussion of selected types of organic reactions (eg addition, substitution, elimination, free radical, rearrangement) to provide a broad cover of the chemistry of aliphatic hydrocarbons, halides, alcohols, ethers and amines. Addition reactions of aldehydes and keytones. Substitution reactions of acid derivatives. Chemistry of benzene and its derivatives with a brief extension to include napthalene chemistry. Survey of geometrical structures, energetics, bonding, reactions and reactivity, spectroscopic and magnetic properties of representative inorganic compounds, including selected main group compounds, compounds of selected transition metals and rare earth elements, and coordination complexes. Applications of inorganic chemistry. **(Old No. 2.002E)**

CHEM2929 Fundamentals of Biological and Agricultural Chemistry **S1 L2 T4**

Prerequisites: CHEM1002 or CHEM1101 and CHEM1201. Excluded 2.013L, BIOC2312.

Aspects of the chemical and physical properties of materials important in biological systems. Methods of separation, of purification and estimation, and correlations of structure with reactivity. Methods of separation and identification, such as gel permeation, discussed as appropriate to each topic. Significance of isomerism in biological systems, optical and geometrical, absolute configuration. Amino acids, peptides and introduction to protein structure. Relevant properties, acid base properties, pK values, zwitterion, isoelectric points. Simple peptide synthesis. Treatment of carbohydrates, establishment of structures, reactivity. Chemistry of monosaccharides, disaccharides and polysaccharides. Methods of analysis, chemical and physiochemical. Fats, correlation of properties with saturated and unsaturated fatty acid composition. Structural chemistry of fatty acids. Reaction of unsaturated fatty acids, urea complexes. Detergents. Trace elements in biological systems. Chemistry of common heterocyclic systems with emphasis on molecules of biological importance. **(Old No. 2.003J)**

CHEM3021 Organic Chemistry **S1 L3 T3**

Prerequisite: CHEM2021. Excluded 2003B

Heterocyclic Chemistry: synthesis and reactions of the following heteroaromatic systems; pyridine, quinoline, isoquinoline, pyrimidine, pyrrole, furan, thiophen, indole, imidazole; exampoles of naturally occuring alkaloids where relevant. *Alicyclic Chemistry:* stereochemistry of acyclic

systems; classical and nonclassical strain in cyclic systems; stereochemistry and conformation of monocylic and polycyclic compounds; synthesis, reactions and rearrangement of monocyclic compounds including stereochemical selectivity; transannular reactions in mediam rings; synthesis and reactions of fused and bridged polycyclic systems; examples of steroids and terpenes where relevant. *Structure Determination:* application of spectroscopic methods (eg nuclear magnetic resonance, mass spectroscopy) to determination of organic structures. **(Old No. 2.103B)**

CHEM3121 Synthetic Organic Chemistry **S2 L2 T4**

Prerequisite: CHEM3021. Excluded 2.013B.

Synthetic methods. Modern functional group transformations with particular reference to positional and sterochemical control; organometallic and carbonionic reagents. *Pericyclic reactions and photochemistry.* Electrocyclic sigmatropic reactions, DielsAlder and related cycloadditions. Woodward-Hoffman rules, ring formation and cleavage. *Synthetic strategy.* Principles of planning or organic synthesis; disconnection approach to representative syntheses of compounds of theoretical and biological interest; use of protecting groups. **(Old No. 2.113B)**

CHEM3229 Organic Chemistry **S1 L2 T4**

Prerequisite: CHEM2021.

The spectroscopic identification of organic compounds, free radical chemistry and electro-organic 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 discussing syntheses and reactions including degradation. **(Old No. 2.030)**

CHEM3311 Environmental Chemistry **S2 L3 T3**

Prerequisites: CHEM2011 and CHEM2041. Excluded 2.043A.

Physico-chemical aspects of the environment. Factors affecting the chemistry of rivers, estuaries, oceans, surface and sub-surface water. Photolysis reactions in the atmosphere, primary and secondary pollutants. Distribution of elements, nutrient elements, carbon and oxygen in ecological systems (chemical models of these cycles). Analysis of naturally occurring species and pollutants. Requirements, validation and performance monitoring of standard analytical procedures. **(Old No. 2.123E)**

CHEM3321 Applied Organic Chemistry **S2 L2 T4**

Prerequisite: CHEM3021. Excluded 2.003L.

Discussion at advanced level of the chemistry of selected commercially important groups of organic materials with emphasis on reaction mechanisms and model systems. *Polymerization processes and synthetic polymers:* Thermal and oxidative polymerization, treatment of initiators, chain transfer agents, retarders; sulfur-olefin reactions. *Pigments and dyestuffs:* Basis of colour in organic compounds, azo, carbonyl, cationic dyes, colour photography; synthetic and natural pigments, eg phthalocyanines, carotenes, flavones, anthocyanins; fluorescent whiteners. *Oxidation and reduction processes:* Oxidation of allylic compounds, phenols, sulfur compounds etc; catalytic dehydrogenation and hydrogenation; hydride and dissolving metal reductions. **(Old No. 2.133B)**

CHEM3926 Instrumental Methods of Food Analysis **S2 L1 T2**

Treatment of theory and practice of modern instrumental methods of analysis, with strong emphasis on the analysis of food constituents. Methods studied include the following:

Spectrophotometry Ultra-violet. Visible. Infra-red. Near infra-red. Fluorimetry. Nuclear magnetic resonance. Mass spectrometry ! also coupled with gas chromatography. Atomic absorption. Inductive coupled plasma.

Other techniques Gas liquid chromatography. High pressure liquid chromatography. Electrophoresis. Selective ion electrodes. Differential scanning colorimetry. Surface colour measurements. **(Old No. 2.0433)**

CHEM3929 Food Chemistry **S1 L2 T4**

Treatment of the following aspects of food chemistry.

Water

The concept of free and bound water, mechanisms of water binding in foods, measurement of free, bound and total water.

Proteins

Chemical properties of different protein types in foods, rheological properties, chemical and thermal coagulation, chemical modification of proteins, methods of analysis: kjeldahl, chlorimetric, NIR.

Carbohydrates

Structures and reactions of sugars, starch, cellulose, pentosans. Vegetable gums, pectins. Caramelisation reactions. Analytical methods. Maillard reaction.

Minerals in foods

Presence and chemical importance of minerals in foods. Effects of minerals on food properties (Ca2+, Fe2+, Mg2+ inter alia), electrochemistry.

Vitamins

Structure, chemical reactions and sources of common vitamins C, B1, B2, B6, Niacin, B12, A, D, Folate. Analytical methods.

Food flavour chemistry

Chemistry of essential oils and volatile food flavour components. Techniques of food flavour research.

Pigments

Chemical structure of natural and synthetic pigments in plant and animal foods. Mechanisms of pigment breakdown, effects of oxidation and pH. **(Old No. 2.043B)**

Civil Engineering

CIVL0616 Structures **S1 L1T2**

Theory of structures: Moduli of elasticity, simple stress and strain. Compound bars, temperature stresses. Thin shells. Stress at a point. Strain at a point. Principal stresses and strains. Relationship between load, shear force and bending moment.

Moments of inertia, principal moments of inertia. Stresses due to axial force, bending moment, shear force, and torsion. Differential equations of simple beam theory. Deflection of beams. Statically indeterminate beams. Strain energy. Deflections at a single load. Shock loads. Theory of centrally loaded column and eccentrically loaded columns. (Old No. 8.6110)

Commerce and Economics

ECON1101 Microeconomics 1 S1 or S2 L2 T1.5 or L2 T2

Prerequisite:	*HSC minimum mark required*
Cont. English or	*60*
2 unit English General or	*60*
2 unit English or	*53*
3 unit English	*1*

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. **(Old No. 15.101E)**

ECON1102 Macroeconomics 1 S1 or S2 L2 T1.5 or L2 T2

Prerequisite: ECON1101.

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. Social accounting and aggregate income and expenditure analysis. Introduction to 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. Analysis of recent Australian macroeconomic experience. **(Old No. 15.102E)**

ECON2101 Microeconomics 2 S1 L2 T2

Prerequisite: ECON1102, ECON1203. Excluded: ECON2103, ECON2121.

Choice theory, including intertemporal choice, labour supply. Extensions of price theory. The theory of production, costs and supply. Market structures including oligopoly models. Introduction to general equilibrium and welfare analysis. Externalities. **(Old No. 15.201E)**

ECON2103 Applied Microeconomics S2 L2 T1.5

Prerequisite: ECON1102. ECON2101, ECON2121.

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. Australia's international trade and investment and the effects of restrictions on international trade and investment. **(Old No. 15.203E)**

ECON2104 Applied Macroeconomics S1 L2 T1.5

Prerequisite: ECON1102, ECON2122. Excluded: ECON2102.

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. Effects of restrictions on capital markets. **(Old No. 15.204E)**

ECON2107 Natural and Environmental Resources Economics S2 L2 T1

Prerequisites: ECON2101 or ECON2103 or ECON2121.

Classification of renewable and non-renewable resources: reserves, resources and resource base; the concept and measurement of resource scarcity, costs, prices and rents; exhaustion of resources, ore quality, exploration, availability of substitutes: uncertainty of discovery, technical progress, market imperfections; renewable resources, sustainable yield concepts. Policy issues, with particular reference to Australia's role in the international economy. **(Old No. 15.207E)**

ECON2108 Industry Economics and Australian Industrial Policy S2 L2 T1

Prerequisite: ECON2101 or ECON2103 or ECON2121.

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 eg on motor vehicles, electronics, steel, petroleum. **(Old No. 15.208E)**

ECON2110 Regional and Urban Economics S1 L2 T1

Prerequisites: ECON2101, ECON2103, ECON2121, ECON2102, ECON2104, ECON2122.

Not offered in 1991.

Theory of urban and regional economics and its policy implications. Regional income and growth, location theory, urban land values and structure, urban growth, the economics of city size, urban transportation and fiscal problems. **(Old No. 15.210E)**

ECON3105 Public Economics A S1 L2 T1

Prerequisites: ECON2101 or ECON2121, ECON2102 or ECON2122.

The theory of public economic activity. Government objectives and the social welfare function. Equity and efficiency criteria. Public goods and externalities. The theory of public sector pricing and its applications. The theory of public sector pricing and its applications. Techniques of investment appraisal, cost-benefit analysis and related issues. The application of cost-benefit analysis to transport, urban and other problems. Analysis of transfer policy. **(Old No. 15.305E)**

ECON3115 Economics of Developing CountriesS1 L2 T1

Prerequisite: Any one of the following: ECON2101, ECON2121, ECON2103, ECON2102, ECON2122, ECON2104.

Aspects of economic development in the less developed countries. Characteristics of these countries and the policies available to them, simplified models of under-development, phenomenon of structural change in the development process, role of industrialization in promoting structural change, international relationships of developing countries and stategies of development based on industry or agriculture. Applications to Asian experiences in economic development. **(Old No. 15.315E)**

Electrical Engineering and Computer Science

ELEC0805 Electronics for Measurement and Control SS 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. (Old No. 6.856)

Banking and Finance

FINS2613 Business Finance 2A S1 or S2 L2 T1

Prerequisite: ACCT1511, ECON1102 and ECON1203.

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. **(Old No. 98.613)**

Information Systems

INFS1602 Computer Information Systems 1 S1 or S2 L2 T1

Prerequisite: ECON1202 or ECON1201 or approved studies in computer science.

Information systems and the organization, architecture of typical commercial application systems, the systems lifecycle, the systems analysis/design task, tools and techniques of the systems analyst, documentation techniques, internal controls and interfacing with the edp auditor, file design concepts, logic and computer hardware, commercial computer programming. **(Old No. 19.602)**

INFS2603 Computer Information Systems 2 S2 L2 T1

Prerequisite: INFS1602. Excluded: INFS3606.

System analysis and design: requirements analysis and specification, logical and physical design of business systems, specification and updating of files, man-machine dialogue procedures. Comparison of design methodologies - top-down and evolutionary. **(Old No. 19.603)**

Industrial Relations and Organizational Behaviour

IROB1701 Industrial Relations 1A S1 or S2 L2 T1.5

Prerequisite:	*HSC minimum mark required*
Cont. English	*60*
2 unit English (General) or	*60*
2 unit English or	*53*
3 unit English	*1*

Multi-disciplinary introduction to a range of important concepts and issues in industrial relations. Political, social, economic, legal, historical and psychological aspects of the evolution and operation of modern employer/employee relations with material drawn from both Australian and overseas experience. 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 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. **(Old No. 30.701)**

Legal Studies and Taxation

LEGT7711 Legal Environment of Commerce S1 or S2 L2 T1

Prerequisite:	*HSC minimum mark required*
Cont. English or	*60*
2 unit English (General) or	*60*
2 unit English or	*53*
3 unit English	*1*

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. **(Old No. 99.774)**

LEGT7731 Legal Regulation of Marketing and Distribution **S1 or S2 L2 T1**

Prerequisite: Nil.

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. **(Old No. 99.776)**

Manufacturing Management

Manufacturing Management is a course offered by the School of Mechanical and Manufacturing Engineering.

MANF0400 Production Management **F L2 T1**

Prerequisites: MATH2021, MATH2841.

Engineering economy: Economic objectives of the firm. Economic measure of performance: net present value, annual equivalent value and the DCF rate of return (including the incremental rate of return) and their application in the selection and replacement of processes and equipment. *The use of human and physical resources:* Methods engineering, ergonomics, motion and time study, financial incentives, applications to machine controlled processes, work sampling and data collection. Plant location, factory layout. *Production and quality control:* Control of jobbing, repetitive batch and continuous production. Manufacturing organisations, functions, inter-relationships and information flow. Sampling techniques in quality control, control charts. *Introduction to inventory control:* Analysis of some engineering planning decisions. *Introduction to operational research:* The formation and optimisation of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, e.g. mathematical programming, queuing theory, inventory models, simulation. (Old No. 18.121)

MANF0401 Production Management A **S1 L3**

Prerequisites: MATH2021, MATH2841 or MATH1011, MATH1021, FIBR2201.

Use of human and physical resources: Methods engineering, ergonomics, motion and time study, financial incentives, applications to machine controlled processes, work sampling and data collection. Plant location, factory layout. *Production and quality control:* Control of jobbing, repetitive batch and continuous production. Manufacturing organisations, functions, inter-relationships and information flow. Sampling techniques in quality control, control charts. *Introduction to inventory control:* Analysis of some engineering planning decisions. (Old No. 18.1211)

MANF4610 Operations Research **F L2 T1**

Prerequisites: MECH1500, MATH2001, MATH2839. Excluded: 6.646.

The formulating and optimisation of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queuing theory, inventory models, replacement and reliability models; simulation. These techniques applied to situations drawn from industrial fields, eg production planning and inventory control. Practical problems of data collection, problem formulation and analysis. (Old No. 18.551)

Marketing

MARK2012 Marketing Systems **S1 L2 T2**

Prerequisite: Nil.

Conceptual introduction to marketing from the systems viewpoint. Evolution and characteristics of marketing systems, buyer behaviour, marketing channel flows (equalizing supply and demand, communication, ownership, finance, physical distribution), marketing activities in the firm (planning and marketing program, co-ordination and control of marketing activities, problem solving, product planning, promotion and pricing, physical distribution management), resources allocation by competition, the expanding role of government, social performance of marketing and social efficiency of marketing. **(Old No. 28.012)**

MARK2052 Marketing Research **S2 L2 T2**

Prerequisite: ECON1203 or approved substitute.

Sources and types of marketing information. Design, conduct, analysis and reporting of market surveys and experiments. Technique of statistical inference. **(Old No. 28.052)**

MARK3073 Strategic Marketing **S1 L2 T2**

Prerequisites: MARK2012 and MARK2052.

Conceptual framework relevant to the practice of marketing management for the further development of an integrative understanding of the market function. Important extensions and limitations of customer orientation and the emergence of a broader concept of marketing; stages of development of a marketing operation, the central role of innovation in opportunity management and the concept of control; importance of product life cycle concept to the formulation of marketing strategy; relationships between corporate and marketing strategy; marketing strategy, future analysis and scenario construction. **(Old No. 28.073)**

MARK3083 Managerial Marketing **S2 L2 T2**

Prerequisite: MARK3073.

Application of theoretical marketing concepts developed in 'Strategic Marketing' and quantitative techniques developed in 'Marketing Models'. Based on the planning, implementation and appraisal of a major field study. **(Old No. 28.083)**

Mathematics

MATH1011 General Mathematics 1B **S1 L4 T2**

Prerequisite:

	HSC Exam Score Range Required
2 unit Mathematics or*	*60-100*
2 and 3 unit Mathematics or	*61-150*
3 and 4 unit Mathematics	*61-200*

Excluded MATH1042, MATH1032

Functions (and their inverses), limits, asymptotes, continuity; differentiation and applications; integration, the definite integral and applications; inverse trigonometric functions; the logarithmic and exponential functions and applications; sequences and series; mathematical induction; the binomial theorem and applications; introduction to probability theory; introduction to 3-dimensional geometry; introduction to linear algebra. **(Old No. 10.021B)**

* the required score may vary slightly from year to year

MATH1021 General Mathematics 1C **S2 L4 T2**

Prerequisite: MATH1011 or Excluded MATH1032, MATH1042.

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. **(Old No. 10.021C)**

MATH1032 Mathematics 1 **F L4 T2**

Prerequisite:

	HSC Exam Score Range Required
2 unit Mathematics or*	*67-100*
2 and 3 unit Mathematics or	*100-150*
3 and 4 unit Mathematics or	*100-200*

Excluded MATH1042, MATH1011, MATH1021

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing. **(Old No. 10.001)**

MATH1042 Higher Mathematics 1 **F L4 T2**

Prerequisite:

	HSC Exam Score Range Required
2 and 3 unit Mathematics	*145-150*
or	
3 and 4 unit Mathematics	*186-200*

Excluded MATH1032, MATH1011, MATH1021

As for MATH1032 Mathematics 1, but in greater depth. **(Old No. 10.011)**

MATH2001 Engineering Mathematics 2 **F L2 T2**

Prerequisite: MATH1032.

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and thier solution for selected physical problems, use of Fourier series; introduction to numerical methods; matrices and their application to theory of linear equations, eigenvalues and thier numerical evaluation; vector algebra and solid geometry; multiple integrals; introduction to vector field theory. **(Old No. 10.022)**

MATH2021 Mathematics **F L1 T1**

Prerequisite: MATH1032 or MATH1042 or MATH1021 CR or

Note A: A unit, together with MATHY3021 which is available to Faculty of Science students as one of a sequence of two units constituting a terminating service course in mathematics. As such it is mutually exclusive to any other Level II or Level III unit in Pure and or Applied Mathematics except that MATH3261 may be taken with MATH2021 and MATH3021.

Note B: 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 will not be 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. **(Old No. 10.031)**

MATH2100 Applied Mathematics 2 I Vector Calculus **S1 or S2 L1.5 T.5**

Prerequisite: MATH1032 Excluded: MATH2110.

Properties of vectors and vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss and Stokes' theorems. Curvilinear co-ordinates. **(Old No. 10.2111)**

MATH2120 Applied Mathematics 2 Mathematical Methods for Differential Equations **S1 or S2 L1.5 T.5**

Prerequisite: MATH1032. Excluded: MATH2130.

Mathematical methods for ordinary and partial differential equations. Series solutions, numerical methods, separation of variables. Fourier series. Bessel functions. **(Old No. 10.2112)**

MATH3021 Mathematics **F L1 T1**

Prerequisite: MATH2021.

Note A: As for Note A in MATH2021 Mathematics.

Note B: Mathematics MATH3021 is included for students desiring to attempt only one Level III Mathematics unit. If other Level III units in Pure Mathematics or Applied Mathematics are taken, MATH3021 Mathematics will not be counted.

Vector calculus; special functions; convolution theorem and applications; complex variable theory; Fourier integrals; Laplace transforms with application to ordinary and partial differential equations. **(Old No. 10.032)**

MATH2819 Statistics SA **F L1.5 T.5**

Prerequisite: MATH1032 or MATH1021. Excluded: MATH2841, MATH2801, MATH2821, MATH2901, MATH2921, BIOS2041.

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. **(Old No. 10.301)**

MATH2849 Statistics SE1 **S1 or S2 L1.5 T.5**

Prerequisite: MATH1032 or MATH1042. Excluded: 10.361.

For students in the School of Electrical Engineering.

Introduction to probability theory, random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions including those of chi-square and t. **(Old No. 10. 3611)**

MATH2859 Statistics SE2 **S1 or S2 L1.5 T.5**

Prerequisite: MATH2849

For students in the School of Electrical Engineering.

Estimation by moments and maximum likelihood; confidence interval estimation. The standard tests of significance with a discussion of power where appropriate.

An introduction to linear regression, auto-regression. Probability limit, law of large numbers and central limit theorem. Multivariate normal distribution. Stochastic processes in discrete and continuous time; Poisson and Gaussian processes. **(Old No. 10.3612)**

Mechanical Engineering

Mechanical Engineering is a course offered by the School of Mechanical and Manufacturing Engineering.

MECH0130 Engineering Drawing and Descriptive Geometry **S1 or S2 L1 T3**

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. **(Old No. 5.0302)**

MECH0330 Engineering Mechanics **SS L2 T2**

Prerequisites: As for MECH1300 Engineering Mechanics 1. Exclusions: MECH1300, MECH0440.

Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames and beams. Simple states of stress. Statics of fluids. Rectilinear motion, curvilinear motion using rectangular and natural co-ordinates. Simple rotation. Equations of motion. Work, energy and power. Impulse and momentum. **(Old No. 5.3000)**

MECH0440 Engineering Statics **S1 or S2 L2 T1**

Prerequisites: As for MECH1300 Engineering Mechanics. Excluded: MECH1300, MECH0330.

Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames and beams. Simple states of stress. Statics of fluids. **(Old No. 5.4000)**

MECH1110 Graphical Analysis and Communication **S2 L1 T2**

Excluded MECH1110, MECH0130.

Descriptive geometry as the basis of analysis and synthesis of spatial relationships: points, lines, plans, solids, intersections. Orthographic and other projection systems. Engineering drawing as a means of definition and communication, selection of views, construction of drawings, conventions, dimensions and tolerancing. Introduction to computer-based drafting systems. **(Old No. 5.0300)**

MECH1300 Engineering Mechanics 1 **S1 or S2 L2 T2**

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

Excluded 5.010, 5.0101, 5.0201.

Note: Students who wish to enrol in this subject in courses other than the full-time courses in Aeronautical Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering and Naval Architecture can make up for the lack of the prerequisite by work taken in Physics in the first half of the first year.

Equilibrium. Friction. Systems of multiforce members, co-plantar 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. (Old No. 5.0011)

MECH1500 Computing 1 M **S2 L/T3**

Introduction: history, applications, hardware, software, a model of a computer system, editors, operating systems. Program design and development: programming objectives, data structures, algorithms, symbolic names, translation of algorithms, steps in programming, programming style, syntax charts, errors and debugging. Data: data types, declarations, input output, file control. Programming constructs: arithmetic expressions, assignment, relational and logical expressions, selection, iteration, intrinsic functions, statement functions, subprograms, common, communication. Applications using existing programs: sorting, word processing, graphics and plotting, simultaneous linear algebraic equations. **(Old No. 5.5010)**

MECH2300 Engineering Mechanics 2A **S1 or S2 L2 T1**

Prerequisites: PHYS1002, PHYS1919 or 1.951, MECH1300, MATH1032 or MATH1042.

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. **(Old No. 5.3021)**

MECH2310 Engineering Mechanics 2B **S1 or S2 L/T2**

Co-requisite: MECH2300.

Differential equations of motion. Transverse vibrations of beams. Whirling of shafts. Single degree-of-freedom systems: free, forced, undamped and damped vibrations. Transmissibility. **(Old No. 5.3022)**

MECH2600 Fluid Mechanics 1 **F L1 T1**

Prerequisites: PHYS1002 or 1.951 or PHYS1919, MECH1300, MATH1032 or MATH1042. Co-requisite: MECH2300.

Units. Fluid properties; fluid statics. Flow fields; unsteady and compressible flow. Bernoulli's equation. Momentum equations. Ideal flow. Flow measurement. Dimensional analysis: similitude; dimensionless numbers; methods of analysis. Steady one dimensional flow in ducts: laminar and turbulent; pressure loss; friction factor; losses in bends and fittings. Elementary boundary layer flow; skin friction and drag. Pumps and turbines. **(Old No. 5.620)**

MECH2700 Thermodynamics 1 **F L1 T1**

Prerequisites: PHYS1002 or 1.951 or PHYS1919, MECH1300, MATH1032 or MATH1042.

Work, energy, power. Units. Systems, states and processes. Control mass and volume. Fluid properties: extensive; intensive. Equation of state. Tables of properties. First law of thermodynamics. Non-flow processes: reversible; irreversible. Flow processes: energy equation; enthalpy. Ideal processes and cycles. Reversibility. The second law of thermodynamics. Entropy. Isentropic processes. Cycles for engines and heat pumps. Energy conversion efficiency. Reciprocating pumps; compressors; engines. Energy analysis; P-V diagrams. Heat transfer. **(Old No. 5.626)**

Microbiology

MICR2011 Microbiology 1 **S2 L2 T4**

Prerequisite: BIOS2011. Co-requisites: BIOS2312 and BIOS2021. Excluded: MICR2201.

This subject is mandatory for students wishing to major in program 4400 Microbiology, it is also offered as a single unit elective. Material presented in the prerequsite unit is taken as "assumed knowledge". An essential component of this course is training in scientific methods, particularly designing and reporting experiments and use of the scientific literature.

The general nature, occurrence and structure of bacteria, fungi, viruses, micro-algae and protozoa; methods for laboratory study of these organisms. Principles and applications of modern bacterial taxonomic techniques, characteristics and behaviour of selected groups of bacteria. Bacterial growth in batch and continuous culture; biosynthetic and bioenergetic mechanisms of bacteria and eukaryotic protista. Interactions of micro-organisms with their environments. **(Old No. 44.121)**

MICR2201 Introductory Microbiology **S1 L2 T4**

Prerequisites: Nil.

An optional unit for students enrolled in courses of the Faculties of Applied Science, Arts, Engineering, Law and Science. It is not available for those who wish to major in any of the science programs offered by the Schools of Biochemistry, Biological Science or Microbiology and Immunology; nor for students enrolled in the Food Technology courses in the Faculty of Applied Science. It is an introduction to the science of Microbiology and does not require any previous knowledge of biology; bridging instruction is given in the first week of the course for students in this category.

The general nature, occurrence and importance of microorganisms; a systematic review of the eukaryotic protista (microalgae, protozoa and fungi), prokaryotic protista (bacteria) and viruses. Relationships between micro organisms and their environment; their impact on man through medical, industrial and environmental applications. Methods for handling bacteria and other micro-organisms; initial training in scientific method through designing and reporting experiments. **(Old No. 44.101)**

MICR2218 Microbiology

This course is solely for students enrolled in the Food Technology BSc courses 3060 and 3070 in the Faculty of Applied Sciences. **(Old No. 44.141)**

Physics

Physics Level I Units

PHYS1002 Physics 1 **F L3 T3**

Prerequisites:	*HSC Exam Score Range Required*
2 unit Mathematics or*	*67-100*
3 unit Mathematics or	*1-50*
4 unit Mathematics	*1-100 or*
and	*(for PHYS1002 only) 10.021B*
2 unit Science (Physics) or	*57-100*
2 unit Science (Chemistry) or	*60-100*
3 unit Science or	*90-150*
4 unit Science or	*1-50*
PHYS1022	

Co-requisite: MATH1021 or MATH1032

*This refers to the 2 Unit Mathematics subject which is related to the 3 Unit Mathematics subject. It does not refer to the subject 2 Unit Mathematics (Mathematics in Society).

Aims and nature of physics and the study of motion of particles under the influence of mechanical, electrical, magnetic and gravitational forces. Concepts of force, inertial mass, energy, momentum, charge, potential, fields. Application of the conservation principles to solution of problems involving charge, veenergy and momentum. Electrical circuit theory, application of Kirchoff's laws to AC and DC circuits. Uniform circular motion, Kepler's laws and rotational mechanics. Properties of matter: solids, liquids, gases. The wave theories of physics, transfer of energy by waves, properties of waves. Application of wave theories to optical and acoustical phenomena such as interference, diffraction and polarization. **(Old No. 1.001)**

PHYS1022 Introductory Physics 1 (For Health and Life Scientists) **F L3 T3**

Prerequisites: Nil. Co-requisite: 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 radio-activity, geometrical optics, optical instruments, wave optics, microscopes and their uses. **(Old No. 1.021)**

Physics Level II Units

PHYS2001 Mechanics, and Computational Physics **S1 L3T1**

Prerequisites: PHYS1002 and MATH1032 or MATH1042 Co-requisite: MATH2100 Excluded PHYS2999, PHYS2021.

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. **(Old No. 1.002)**

PHYS2011 Electromagnetism and Thermal Physics **S2 L3 T1**

Prerequisites: PHYS1002, MATH2100.Co-requisite: MATH2100 Excluded ELEC2013, PHYS2999..

Electric field strength and potential, Gauss' law, Poisson's and Laplace's equations, capacitance, dielectrics and polarization, magnetism, electro-magnetic induction, Maxwell's equations, electromagnetic waves. Laws of thermodynamics, kinetic theory, microscopic processes, entropy, solid state defects, Helmholtz and Gibbs functions, Maxwell's relations, phase diagrams, chemical and electrochemical potential. **(Old No. 1.012)**

PHYS2021 Quantum Physics and Relativity **F L1.5 T.5**

Prerequisites: PHYS1002, MATH1032.
Excluded: PHYS2989.

Special theory of relativity: time dilation, length contraction, simultaneity, Lorentz transformations, energy and mass. Photon properties, de Broglie relations, Uncertainty principle, operators in quantum mechanics, postulates of quantum mechanics, potential wells, steps and barriers, harmonic oscillator, H atom, angular momentum, magnetic moment, electron spin, nuclear spin. Atomic and molecular spectra, lasers, quantum statistics, free electron model of a metal, band theory; nuclear size, density, mass; nuclear models, fissionand fusion, nuclear forces. **(Old No. 1.022)**

PHYS2031 Laboratory **F T3**

Prerequisites: PHYS1002, MATH1032.Excluded PHYS2920.

Alternating current circuits, complex impedance, resonance, mutual inductance, introductory electronics, diode and characteristics and circuits, power supplies, transistor characteristics, single stage and coupled amplifiers, experiments using AC circuits. Experimental investigations in a choice of areas including radioactivity, spectroscopy, properties of materials, Hall effect, nuclear magnetic resonance, photography, vacuum systems. **(Old No. 1.032)**

PHYS2920 Electronics **S1 L1 T2**

Prerequisites: PHYS1002 or PHYS1022. Excluded PHYS2031.

The application of electronics to other disciplines. Includes: principles of circuit theory; amplifiers, their specification and application, transducers; electronic instrumentation; industrial data acquisition. **(Old No. 1.9222)**

Physics Level III Units

PHYS2940 Introduction to Physics of Measurement **S1 L1.5 T1.5**

Prerequisite: PHYS1002.

Resolution: accuracy and sensitivity of instruments, errors of observation; experimental design; transducers; thermometry; electrical noise; servo systems, mechanical design of apparatus; optical instruments optical fibres; photometry; calorimetry; analogue to digital conversion and digital instruments; measurement of very large and very small quantities. **(Old No. 1.9422)**

PHYS3021 Statistical Mechanics and Solid State Physics **S1 L3 T1**

Prerequisites: PHYS2011, PHYS2021.

Canonical distribution, paramagnetism, Einstein solid, ideal gas, equipartition, grand canonical ensemble, chemical potential, phase equilibria, Fermi and Bose statistics, Bose condensation, blackbody radiation. Crystal structure, bonding, lattice dynamics, phonons, free-electron models of metals, band theory, point defects, dislocations. **(Old No. 1.023)**

PHYS3060 Advanced Optics **S2 L1.5 T.5**

Co-requisite: PHYS2001.

Fresnel and Fraunhofer diffraction, Fourier transforms, filtering, coherence length and time, stellar interferometers, laser theory, non-linear optics. **(Old No. 1.0343)**

PHYS3110 Experimental Physics B1 **S1 T4**

Prerequisite: PHYS2031.

Selected experiments and projects. Advanced experimental techniques and open ended projects in the areas covered in PHYS.043 Experimental Physics A together with projects involving electron and nuclear magnetic resonances, low temperature physics and super-conductivity. Fourier optics, holography. **(Old No. 1.0533)**

PHYS3120 Experimental Physics B2 **S2 T4**

Prerequisite: PHYS2031.

As for PHYS3110 Experimental Physics B1. **(Old No. 1.0543)**

PHYS3410 Biophysics **S1 L2 T1**

Prerequisites: PHYS2011, PHYS2021.

Thermodynamics in biology, electrochemical potentials, Donnan equilibrium, irreversible processes, diffusion and applications to biological systems. Membrane potentials. Nernst potential, Goldman and Nernst-Planck equation, generalized approach. Active transport. Membrane structure. The nerve impulse, activation and inactivation, Hogkin and Huxley equations. Muscle, contractive process, thermodynamics. Ecological ensemble theory, global thermodynamics interaction of species, ecological associations. **(Old No. 1.1433)**

PHYS3710 Lasers and Applications **S1 L1.5 T.5**

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. **(Old No. 1.7113)**

Graduate Study

Accounting

ACCT5940 Accounting and Financial Management A **S1 L2 T1**

Prerequisite: Nil.

An introduction to financial accounting and reporting for companies. Financial information systems design; internal controls. Traditional and alternative concepts and measures. Thinking about accounting. **(Old No. 14.940G)**

ACCT5956 Management Planning and Control **S2 L3**

Prerequisite: ACCT5996 or IROB 5901 or ACCT5989 or equivalent.

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. **(Old No. 14.956G)**

Biological Science

BIOS3014 Ecological Studies in Arid Lands Management **S2 L2 T4**

Prerequisite: Degree with background in bioscience or equivalent.

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. **(Old No. 45.900G)**

Chemistry

CHEM7325 Toxicology, Occupational and Public Health **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 man. 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. **(Old No. 2.251G)**

Civil Engineering

CIVL9402 Transport, Environment, Community **F C6**

Effect of transport on public health, environment and communities. Analysis of unwanted effects of transport activity: accidents, noise, pollution, intrusion; causation, measurement, preventative and remedial action. Community reaction to transport activity; government, bureaucracy and public involvement in transport policy and environment impact statements. **(Old No. 8.402G)**

CIVL9788 Site Investigations **S1 C3**

Engineering geology mapping and terrain classification. Drilling, trenching and sampling of rock and soil. In-situ testing of soil and rock. Laboratory testing of soil and rock. Assessment of design parameters. Instrumentation to measure pore pressure, stress, displacement. **(Old No. 8.788G)**

CIVL9790 Stability of Slopes **S1 C3**

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. **(Old No. 8.790G)**

CIVL9842 Groundwater Hydrology **SS C3**

Confined and unconfined aquifers, analogue and digital models of aquifer systems, water movement in the unsaturated zone, recharge, groundwater quality, sea water intrusion. **(Old No. 8.842G)**

CIVL9847 Water Resources Policy **S2 C3**

Resource economics, water supply, water demand, multiple objective planning, multiple purpose projects, water law, water administration, case studies. **(Old No. 8.847G)**

CIVL9849 Irrigation **S1 C3**

Soils, soil-water relationships, plants, climate, crop requirements; water budgets, sources, quality, measurement;

irrigation efficiency. Design of irrigation systems, appurtenant works, distribution. **(Old No. 8.849G)**

CIVL9851 Unit Operations in Public Health Engineering **S1 C3**

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. **(Old No. 8.851G)**

CIVL9857 Sewage Treatment and Disposal **S2 C3**
(Old No. 8.857G)

CIVL8857 Sewage Treatment and Disposal (external) **S2 C3**

Application of processes and process variations used to improve the quality of sewage effluent, and the disposal of the effluent. Re-use of effluents where applicable. Sludge treatment and disposal. **(Old No. 8.857X)**

CIVL9858 Water Quality Management **SS C3**

Fundamental concepts; systems approach to quality aspects of water resource systems; quality interchange systems; quality changes in estuarine, surface, and ground water. Quality management by engineered systems. Economic criteria relating to water use and re-use systems. **(Old No. 8.858G)**

CIVL9861 Investigation of Groundwater Resources 2 **SS C3**

Geophysical methods, remote sensing, photo-interpretation, arid- environment studies, analog models, case studies. **(Old No. 8.861G)**

CIVL9864 Arid Zone Hydrology **SS L1.5 T1.5 C3**

Arid zone rainfall characteristics, data collection and instrumentation, runoff processes, infiltration, transmission loss, recharge processes, flood characteristics and design; water yield, storage of water; evaporation and evaporation suppression; sediment transport and measurements. **(Old No. 8.864G)**

CIVL9865 Arid Zone Water Resources Management **SS L1.5 T1.5 C3**

Water as a resource: demand for and supply of water; works and management to match demand with supply. Special features of the arid zone climate, water uses, quantification of demand quantities and qualities; measurement of flow rate, volume, quality. Engineering works: design, construction, operation and maintenance of work, including excavation tanks, dams, pipelines, pumps, windmills, engines and motors, troughs; costs; reliability; energy sources for pumping. Special practices: water spreading, irrigation including trickle irrigation; evaporation reduction, desalination. **(Old No. 8.865G)**

CIVL9868 Public Health Science **SS C3**

Impact of water and wastewater treatment on disease transmission. Monitoring methods used for pathogens and indicator organisms, structure and degradation of large molecules, biochemical pathways of anabolism and catabolism and the characterization of micro-organisms. **(Old No. 8.868G)**

CIVL9870 Hydraulics and Design of Water and Wastewater Treatment Plants **SS C3**

Corequisites: CIVL 9856, CIVL 9857 or equivalent.

Application of hydraulic principles to flows within treatment plants. Selection and integration of unit processes required for water and wastewater treatment, plant layout, plant design including hydraulic profiles, the influence of flow and load variability, instrumentation and control strategies. **(Old No. 8.870G)**

CIVL9872 Solid Waste Management **S2 L2 T1 C3**
(Old No. 8.872G)

CIVL8872 Solid Waste Management (external) **S2 C3**

Economics of all elements of solid waste management. Collection: route design, equipment, labour. Transfer and transport, recycling, processing, incineration. Planning of solid waste systems. Fundamentals of management. **(Old No. 8.872X)**

CIVL8873 Waste and Wastewater Analysis and Environmental Requirements (external) **S1 C3**

Principles of analytical methods used in chemical analysis of wastes and wastewaters, sampling schemes, statistical evaluation of data, environmental requirements to prevent pollution. **(Old No. 8.873X)**

CIVL9874 Waste Management Science **S1 L2 T1 C3**
(Old No. 8.874G)

CIVL8874 Waste Management Science (external) **S1 C3**

Aspects of chemistry, biology and geology relevant to waste management, equilibrium and kinetic approaches, cell structure and metabolisms, formation and classification of rocks and soils. **(Old No. 8.874X)**

CIVL9875 Hydrological Processes **S1 C3**

Hydrological cycle, water and energy balances and circulation, precipitation process, interception, infiltration, storm runoff process, evaporation and transpiration, surface groundwater interactions, land use effects. **(Old No. 8.875G)**

CIVL9880 Groundwater Modelling **SS C3**

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. **(Old No. 8.880G)**

CIVL9881 Hazardous Waste Management **S2 C3**
(Old No. 8.881G)

CIVL8881 Hazardous Waste Management (external) **S2 C3**

Characteristics of hazardous wastes, such as dioxins, PCB's, chlorinated organic pesticides, explosives, heavy metals, arsenic and cyanide.

Transportation, treatment and disposal of hazardous wastes, incineration, secure landfill, risk assessment, social issues relating to hazardous waste management. **(Old No. 8.881X)**

CIVL9882 Industrial Waste Management **S1 C3**
(Old No. 8.882G)

CIVL8882 Industrial Waste Management (external) **S1 C3**

Atmospheric Pollution Control: Meterology, effects of air pollutants, characteristics of specific air pollutants (particulates, sulphur oxides, nitrogen oxides), air pollution control techniques. Liquid and Solid Wastes: low and medium toxicity wastes, oily and greasy wastes from the petro-chemical and food industries, organic wastes, mining wastes, plating and metal working wastes, nitrogenous wastes. **(Old No. 8.882X)**

CIVL9883 Sources of Waste and Landfill Disposal **S2 C3**
(Old No. 8.883G)

CIVL8883 Sources of Waste and Landfill Disposal (external) **S2 C3**

Sources, quantitites and characteristics of residential, commercial and industrial solid waste. Landfill: site selection, design, operation, equipment selection, leachate, gas protection, legal guidelines. **(Old No. 8.883X)**

Electrical Engineering and Computer Science

COMP9311 Data Base Systems **C3**

Prerequisites: Knowledge of storage structures. Excluded: 6.659G, LIBS 0823

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. **(Old No. 6.005G)**

ELEC9336 Digital Communication Networks **C3**

Excluded ELEC9737, ELEC4351, ELEC4352.

Introduction to data communication. Analog versus digital transmission. Transmission media. LAN's; WAN's, ISDN. Protocols: IEEE standards for LAN's; fibre optic networks; satellite networks. OSI reference model. Some design issues and examples: topics include error detection and correction; routing and congestion control; internetworking; connection management; data representation and coding; file management; electronic mail. **(Old No. 6.336G)**

ELEC9408 Computer Display Systems and Interactive Instrumentation **C3**

Prerequisite: COMP9221.

Man-machine-process communication and control, and associated microprocessor based instrumentation. Review of appropriate analog and digital technology. Microcomputer hardware and programming for interactive communication using both machine and high-level languages. Display devices, operating principles and performance limitations. Hardware and software techniques for computer-generation and processing of pictures. Colour and movement. Interactive design and graphics creation. The geometry of transformations and projections. Light pens and other input devices. **(Old No. 6.468G)**

REMO9580 Image Analysis In Remote Sensing **C3**

Prerequisite: MATH 2849 and MATH 2859.

Techniques for extracting information from remotely sensed data with particular emphasis on satellite imagery. Topics taken from: nature and characteristics of earth resources and related satellites; satellite sensors and data formats; image enhancement techniques; image classification methods, including clustering, classification and feature selection; image classification methodologies; new horizons in remote sensing image analysis. **(Old No. 97.580G)**

REMO9581 Microwave Remote Sensing **C3**

Use of passive and active (radar) microwave techniques in remote sensing of earth resources. Topics include: real and synthetic aperture radar systems; passive microwave radiometry; energy-surface interactions; interpretation of microwave image data: applications in agriculture, geology, oceanography and hydrology; issues in signal and image processing; characteristics of airborne and spaceborne microwave sensors. **(Old No. 97.581G)**

Banking and Finance

FINS5517 Investment Analysis and Management **S2 L3**

Prerequisite: FINS5513 or equivalent.

The scope and nature of investment analysis and management. Investment analysis and management and the treasury function. Source of information on investments. The valuation process and approaches to valuation as applied to the full range of securities. Investment strategies; portfolio selection including the use of specialist markets for hedging: regulatory

constraints. The efficient market hypothesis and the pricing of securities in the Australian Capital Market. Security analysis in an efficient market; evaluation of portfolio performance, fund management, the performance of investment companies. **(Old No. 98.868G)**

Graduate School of the Built Environment

GSBE1101 Community Noise Control **S1 L1 T1 C2**

Introduction; sound and sound propagation, sound power, sound pressure, decibels; sound perception, psychoacoustics loudness, annoyance, phons and dBA; hearing conservation; acoustic measuring and analysing instruments sound level meters, filters, analysers, recorders; sound sources; community noise assessment; the NSW Noise Control Act; practical exercises in sound recording, analysis and assessment; noise control source noise reduction, use of barriers, enclosures, distance, sound absorbing materials; sound transmission through building elements; noise components of environmental impact statements. **(Old No. 39.908G)**

Information Systems

INFS5957 Operations Research for Management 1 **S2 L3**

Prerequisites: ACCT5996 and approved Quantitative Methods background or equivalent. MCom(Hons) degree course candidates-approval of Head of School of Information Systems.

Application of mathematical and statistical techniques to the solving of management problems with some emphasis on short term forecasting. The structuring of the decision problem, mathematical model construction, mathematical programming, probability and statistical decision theory, inventory and queueing theory. Simulation models and applications with particular reference to models of business organizations. **(Old No. 19.957G)**

Industrial Relations and Organizational Behaviour

IROB5701 Industrial Relations A **S1**

Prerequisites: Nil.

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 **S1 or S2**

Exclusions: IROB 5906.

The aim is to provide insights into factors that shape the organization of work, the worker and managerial responses and action. Theories of organizational behaviour will be examined with a view to their application. Perception and learning; commitment and motivation, conflict and control. Issues at the individual level will include orientation to work, participation and stress. The design of work and reward structures, work group processes and organizational culture and change will be included. **(Old No. 30.935G)**

Landscape Architecture

LAND9010 Conservation Studies

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. **(Old No. 37.504G)**

LAND9111 Landscape Planning **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. Participationin a planning exercise applying these skills and knowledge using simple computing techniques. **(Old No. 37.901G)**

LAND9213 Land Systems and Management **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. **(Old No. 37.161G)**

Legal Studies and Taxation

LEGT5511 The Legal Environment of Business **S2 L3**

Prerequisite: Nil.

An introduction to the Australian legal system; the legal framework of business regulation: areas of substantive law relevant to commerce including the general principles of the law of contract, specialised commercial transactions, the regulation of restrictive trade practices and sales promotion. **(Old No. 99.971G)**

LEGT5541 Company Law **S1 L3**

Prerequisite: LEGT5511.

The law relating to business organizations, including partnerships, joint ventures, trading trusts, and companies incorporated under the Companies New South Wales Code. Primary focus: company law and, in particular, the company as a corporate entity; capital; control and management; liquidation. **(Old No. 99.920)**

Librarianship

LIBS0815 Economics of Information Systems **S1**

Use of surveys, user studies and market research to determine demand. Costing, financial planning, control and forecasting. Cost-benefit analysis. Economics of networks. Economic implications of new technologies. **(Old No. 55.815G)**

LIBS0817 Information Storage and Retrieval Systems **F**

Role of thesauri and other indexing language structures. Automated thesaurus design and maintenance. Automatic indexing and classification systems. Concept co-ordination, use of Boolean operators and search strategy design. Systems analysis, design and costing. Design of user and interactive cueing tutorials. Choice criteria for on-line and batch systems. Testing, analysis and evaluation of systems. Advanced technologies for information storage and retrieval. **(Old No. 55.817G)**

Marketing

MARK5903 International Marketing **S1 or S2 L3**

Prerequisites: MARK5929 or co-requisite or Head of School's approval. Note: Different prerequisites apply for MCom(Hons) degree course.

Character and dimension of the political, economic, modernization (including administrative_ and social aspects affecting international marketing; the dynamic relationship between the environmental aspects and international domestic marketing. Operational aspects of international marketing; nature of competition marketing structure and channels, trade barriers, etc., as well as international, regional, sub-regional economic groupings with emphasis on marketing in Asia, particularly Japan. **(Old No. 28.903G)**

MARK5905 Marketing Strategy **S1 or S2 L3**

Prerequisite: MARK5929.

Note: Different prerequisites apply for MCom(Hons) degree course. Plays an integrating role, enabling the student to consider the implication of the specialized courses for the problem of for mulating marketing strategy. While the teaching method centres on the use of Australian cases, students are expected to read widely in the relevant journals and to contribute insights from this reading to discussions. **(Old No. 28.905G)**

Australian Graduate School of Management

MNGT0204 Money and Financial Policy.

Recommended: MNGT0200 or consent of instructor.

How and why the government sets monetary and interest rate policy, and how corporations respond in financial markets. An evaluation of current controversies about domestic and international monetary policy, including the effects of deregulation and financial innovation on theory and practice. Examples drawn from several countries. **(Old No. 85.0204)**

MNGT0385 Business-Government Relations

The relationship between business and government in Australia in historic and comparative contexts. Recent critiques of the political and social role of corporations, the emerging business government issue agenda, developments in the institutional pattern mediating business-government relations. Evolution of the public affairs function. **(Old No. 85.0385)**

Centre for Safety Science

SAFE9242 Human Behaviour and Safety Science **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. **(Old No. 47.120G)**

SAFE9543 Management of Dangerous Materials **C3**

Introduction. Atmospheric dispersion of gaseous and particulate materials. Protection against dangerous materials for operators and other personnel. Storage, handling and transport of flammable liquids, dangerous goods and cryogenic material. Storage and transport of compressed gases. Disposal of dangerous materials; incinerators; flare stacks, landfill, dispersal. Treatment of wastewaters. Relevant legislation. Field excursion. **(Old No. 47.481G)**

Surveying

SURV9107 Special Topic in Surveying B **C3**

A special subject taken by an individual student or a small group of students by private study in conjunction with tutorial sessions with the member(s) of staff in charge of the subject. **(Old No. 29.107G)**

SURV9211 Introduction to Geodesy **S1 L2 T1 C3**

Geodesy in the service of mankind. The earth's gravity field. The earth's motion in space. Co-ordinate and time systems used in geodesy. Horizontal and vertical control networks. Earth satellite motion. Principles of satellite positioning. Gravimetric geodesy. Space geodetic methods. Variations of geodetic positions with time. **(Old No. 29.211G)**

SURV9213 Physical Metereology **S2 L2 T1 C3**

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. **(Old No. 29.213G)**

SURV9532 Computer-Assisted Mapping **SS L2 T1 C3**

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. Automation of mapping procedures. Archival of digital map data. Mapping systems based on computer assisted techniques. **(Old No. 29.532G)**

SURV9600 Principles of Remote Sensing **S1 L2 T1 C3**

History and development. Definition and physics of basic electromagnetic radiation quantities. Basic-energy matter relationship. Spectral signatures of surfaces. Atmospheric considerations and the reduction of atmospheric effects. Sensor concepts including film and electro-optical sensors. An introduction to data processing and enhancement, including image interpretation procedures. **(Old No. 29.600G)**

SURV9602 Remote Sensing Procedures **S2 L2 T1 C3**

Review of atmospheric correction procedures and application to multi-temporal Landsat MSS data. Review of image registration, enhancement and classification procedures with particular reference to multi-source remote sensing data sets. Analysis of techniques over a varied land use area. Land use change project and analysis using multi-source and multi-temporal remotely sensed imagery, including Landsat MSS, TM, SPOT and SAR. **(Old No. 29.602G)**

SURV9604 Land Information Systems **SS L2 T1 C3**

Land information as maps and records. Methods of data collection. Integrated surveys and coordinate systems. Legal boundaries. Land tenure. Identifiers. Computerization of land information. Data input methods. Data storage methods. Data processing and manipulation, including management, searching, existing data base languages, and interactive data editing. Data output, including computer graphics, line printer maps, and digital plotters. Application of Arc-Info LIS software. **(Old No. 29.604G)**

SURV9605 Ground Investigations for Remote Sensing **S1 L2 T1 C3**

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. **(Old No. 29.605G)**

Town Planning

Graduate Study

PLAN0911 The Organization of Town Planning

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, decision-making 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.

Graduate Study

Conditions for the Award of Higher Degrees

First Degrees

Rules, regulations and conditions for the award of first degrees are set out in the appropriate Faculty Handbooks.
For the list of undergraduate courses and degrees offered see Table of Courses by Faculty (Undergraduate Study).

Higher Degrees

The following is the list of higher degrees and graduate diplomas of the University, together with the publication in which the conditions for the award appear.
For the list of graduate degrees by research and course work, arranged in faculty order, see Table of Courses (by faculty): Graduate Study in the Calendar.

For the statements Preparation and Submission of Project Reports and Theses for Higher Degrees *and* Policy with respect to the Use of Higher Degree Theses see later in this section.

Higher Degrees

Title	Abbreviation	Calendar/Handbook
Doctor of Science	DSc	Calendar
Doctor of Letters	DLitt	Calendar
Doctor of Laws	LLD	Calendar
Doctor of Medicine	MD	Medicine
Doctor of Philosophy	PhD	Calendar and all handbooks
Master of Applied Science	MAppSc	Applied Science
Master of Architectural Design	MArchDes	Architecture
Master of Architecture	MArch	Architecture
Master of Archives Administration	MArchivAdmin	Professional Studies
Master of Arts	MA	Arts University College
Master of Biomedical Engineering	MBiomedE	Engineering
Master of Building	MBuild	Architecture
Master of the Built Environment	MBEnv	Architecture

Higher Degrees (continued)

Title	Abbreviation	Calender/Handbook
Master of the Built Environment (Building Conservation)	MBEnv	Architecture
Master of Business Administration	MBA	AGSM
Master of Chemistry	MChem	Sciences*
Master of Cognitive Science	MCogSc	Arts
Master of Commerce (Honours)	MCom(Hons)	Commerce & Economics
Master of Commerce	MCom	Commerce & Economics
Master of Community Health	MCH	Medicine
Master of Education	MEd	Professional Studies
Master of Educational Administration	MEdAdmin	Professional Studies
Master of Engineering	ME	Applied Science Engineering University College
Master of Engineering without supervision	ME	Applied Science Engineering
Master of Engineering Science	MEngSc	Engineering Applied Science University College
Master of Environmental Studies	MEnvStudies	Applied Science
Master of Health Administration	MHA	Professional Studies
Master of Health Personnel Education	MHPEd	Medicine
Master of Health Planning	MHP	Professional Studies
Master of Industrial Design	MID	Architecture
Master of Landscape Architecture	MLArch	Architecture
Master of Landscape Planning	MLP	Architecture
Master of Laws	LLM	Law
Master of Librarianship	MLib	Professional Studies
Master of Management Economics	MMgtEc	University College
Master of Mathematics	MMath	Sciences*
Master of Music	MMus	Arts
Master of Nursing Administration	MNA	Professional Studies
Master of Optometry	MOptom	Sciences*
Master of Paediatrics	MPaed	Medicine
Master of Physics	MPhysics	Sciences*
Master of Project Management	MPM	Architecture
Master of Public Health	MPH	Medicine Professional Studies
Master of Psychology (Applied)	MPsychol	Sciences
Master of Psychology (Clinical)	MPsychol	Science
Master of Psychotherapy	MPsychotherapy	Medicine
Master of Safety Science	MSafetySc	Engineering
Master of Science	MSc	Applied Science Architecture Engineering Medicine Sciences* University College
Master of Science *without supervision*	MSc	Applied Science Architecture Engineering

Title	Abbreviation	Calender/Handbook	
Master of Science *without supervision* (continued)	MSc	Medicine Sciences* University College	**Higher Degrees (continued)**
Master of Science (Acoustics)	MSc(Acoustics)	Architecture	
Master of Science (Industrial Design)	MSc(IndDes)	Architecture	
Master of Science and Society	MScSoc	Arts	
Master of Social Work	MSW	Professional Studies	
Master of Statistics	MStats	Sciences*	
Master of Surgery	MS	Medicine	
Master of Surveying	MSurv	Engineering	
Master of Surveying *without supervision*	MSurv	Engineering	
Master of Surveying Science	MSurvSc	Engineering	
Master of Town Planning	MTP	Architecture	
Master of Welfare Policy	MWP	Professional Studies	
Graduate Diploma	GradDip	Applied Science Architecture Engineering Sciences*	**Graduate Diploma**
	DipPaed	Medicine	
	DipEd DipIM-ArchivAdmin DipIM-Lib	Professional Studies	
	DipFDA	Sciences*	

*Faculty of Science.

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 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 Bill of Rights for postgraduate research students.

(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 or supervisors or under other appropriate supervision arrangements approved by the Committee. Normally an external candidate within another organisation or institution will have a co-supervisor at that institution.

Progression

4.The progress of the candidate shall be considered by the Committee following report from the School in accordance with the procedures established within the School and previously noted by the Committee.

(i)The research proposal will be reviewed as soon as feasible after enrolment. For a full-time student this will normally be during the first year of study, or immediately following a period of prescribed coursework. This review will focus on the viability of the research proposal.

(ii)Progress in the course will be reviewed within twelve months of the first review. As a result of either review the Committee may cancel enrolment or take such other action as it considers appropriate. Thereafter, the progress of the candidate will be reviewed annually.

Thesis

5.(1)On completing the program of study a candidate shall submit a thesis embodying the results of the investigation.

(2)The candidate shall give in writing to the Registrar two months notice of intention to submit the thesis.

(3)The thesis shall comply with the following requirements:

(a)it must be an original and significant contribution to knowledge of the subject;

(b)the greater proportion of the work described mu • 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 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:

(a)The thesis merits the award of the degree.

(b)The thesis merits the award of the degree subject to minor corrections as listed being made to the satisfaction of the head of school.

(c)The thesis requires further work on matters detailed in my report. Should performance in this further work be to the satisfaction of the higher degree Committee, the thesis would merit the award of the degree.

(d)The thesis does not merit the award of the degree in its present form and further work as described in my report is required. The revised thesis should be subject to re-examination.

(e)The thesis does not merit the award of the degree and does not demonstrate that resubmission would be likely to achieve that merit.

(3)If the performance at the further work recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to re-present the same thesis and submit to further examination as determined by the Committee within a period specified by it but not exceeding eighteen months.

(4)The Committee shall, after consideration of the examiners' reports and the results of any further work, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate be permitted to resubmit the thesis after a further period of study and/or research.

7.A candidate shall pay such fees as may be determined from time to time by the Council. Fees

*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.

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. **Master of Applied Science (MAppSc) and Master of Environmental Studies (MEnvStudies)**

2. (1) A candidate of the degree shall: Qualifications

(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.

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. Enrolment and Progression

*Or department where a department is not within a school, or schools or departments where the research is being undetaken in more than one school or department.

(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.

4. A candidate shall pay such fees as may be determined from time to time by the Council. Fees

Master of Engineering (ME) and Master of Science (MSc)

1. The degree of Master of Engineering or Master of Science by research may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee) to a candidate who as demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the degree.

(3) When the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant, before being permitted to enrol, to undergo such examination or carry out such work as the Committee may prescribe.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one calendar month before the commencement of the session in which enrolment is to begin.

(2) In every case, before permitting a candidate to enrol, the head of the school (or department) in which the candidate intends to enrol shall be satisfied that adequate supervision and facilities are available.

(3) An approved candidate shall be enrolled in one of the following categories:

(a) full-time attendance at the University;

(b) part-time attendance at the University;

(c) external - not in regular attendance at the University and using research facilities external to the University

(4) A candidate shall be required to undertake an original investigation on an approved topic. The candidate may also be required to undergo such examination and perform such other work as may be prescribed by the Committee.

(5) The work shall be carried out under the direction of a supervisor appointed from the full-time members of the University staff.

(6) The progress of a candidate shall be reviewed annually by the Committee following a report by the candidate, the supervisor and the head of the school (or department) in which the candidate is enrolled and as a result of such review the Committee may cancel enrolment or take such other action as it considers appropriate.

(7) No candidate shall be granted the degree until the lapse of three academic sessions in the case of a full-time candidate or four academic sessions in the case of a part-time or external candidate from the date of enrolment. In the case of a candidate who has been awarded the degree of Bachelor with Honours or who has had previous research experience the Committee may approve remission of up to one session for a full-time candidate and two sessions for a part-time or external candidate.

(8) A full-time candidate for the degree shall present for examination not later than six academic sessions from the date of enrolment. A part-time or external candidate for the degree shall present for examination not later than ten academic sessions from the date of enrolment. In special cases an extension of these times may be granted by the Committee.

Thesis

4. (1) On completing the program of study a candidate shall submit a thesis embodying the results of the original investigation.

(2) The candidate shall give in writing two months notice of intention to submit the thesis.

(3) The thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses.

(6) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

Examination

5. (1) There shall be not fewer than two examiners of the thesis, appointed by the Academic Board on the recommendation of 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 re-present the same thesis and submit to a further oral, practical or written examination within a period specified by it but not exceeding eighteen months.

(4) The Committee shall, after consideration of the examiners' reports and the reports of any oral or written or practical examination, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

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 Academic 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 Academic Board on the recommendation of 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 re-present the same thesis and submit to further examination as determined by the Committee within a period specified by it but not exceeding eighteen months.

(5) The Committee shall, after consideration of the examiners' reports and the results of any further examination, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Environmental Studies (MEnvStudies)

See Master of Applied Science above.

Master of Science (MSc)

See Master of Engineering above.

Master of Science (MSc) without supervision

See Master of Engineering without supervision above.

Graduate Diploma

Graduate Diploma (GradDip)

Qualifications

1. A Graduate Diploma may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

2. (1) A candidate for the diploma shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee).

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the diploma.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribed, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the diploma shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the diploma shall be required to undertake such formal subjects and pass such assessment as prescribed.

(3) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the diploma until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate and six sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

4. A candidate shall pay such fees as may be determined from time to time by the Council. Fees

Scholarships and Prizes

The scholarships and prizes listed below are available to students whose courses are listed in this handbook. 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 scholarhips and prizes offered throughout the University.

Scholarships

Undergraduate Scholarships

Listed below is an outline only of a number of 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.

Donor	Value	Year/s of Tenure	Conditions
General			
Bursary Endowment Board*	$200 pa	Minimum period of approved degree/ combined degree course	Merit in HSC and total family income not exceeding $6000
Sam Cracknell Memorial	Up to $3000 pa payable in fortnightly instalments	1 year	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	Up to $1500 pa	1 year renewable for the duration of the course subject to satisfactory progress and continued demonstration of need	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.

*Apply to The Secretary, Bursary Endowment Board, PO Box 460, North Sydney 2060, immediately after sitting for HSC.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
W.S. and L.B. Robinson**	Up to $4200 pa	1 year renewable for the duration of the course subject to satisfactory progress	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.
Alumni Association	Up to $1500 pa	1 year with the possibility of renewal	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 overseas students.
**Applications close 30 September each year.			
Applied Science			
Malcolm Chaikin Foundation Scholarship	Up to $8000 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia and in the first year in the Faculty of Applied Science enrolled ;in a course leading to the degree of Bachelor of Science or Engineering.
Applied Biosciences *Food Science and Technology*			
Coca-Cola Export Corporation	Up to $1800 pa	1 year renewable for the duration of the course subject to satisfactory progress	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.
George Weston Foods Ltd	Up to $4000 over 4 years		
CAFTA-New South Wales	$500 pa	1 year renewable	Permanent residence in Australia. Eligible for admission to Year 2, 3 or 4 of course three available.
Chemical Engineering and Industrial Chemistry			
Bridge Oil Ltd	Up to $8800 pa		Permanent residence in Australia living in Queensland and must have completed the first two years of any accredited engineering program in that state
Society of Petroleum Engineers Pty Ltd	Up to $2500		Permanent residence in Australia living in specified state and must have completed the first two years of any accredited engineering program in that state
Proctor & Gamble Australia Pty Ltd	Up to $2500	1 year	Permanent Residence in Australia and in the final year of the chemical engineering course.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Applied Science (continued)			
Fibre Science and Technology			
Textile Technology			
Australian Wool Corporation	Up to $2500	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to the full-time degree course in Textile Technology
Wool and Animal Science			
Merck, Sharp and Dohme	Up to $1000 pa	1 year renewable for the duration of the course subject to satisfactory progress	Eligibility for admission to the full-time degree course in Wool and Pastoral Sciences
Australian Wool Corporation	Up to $2500 pa		
Dalgety Farmers Bicentennial	Up to $2500 pa		
Materials Science and Engineering			
Materials			
Australian Ceramic Society	Up to $400 pa		
The Clay Brick Association of New South Wales	Up to $2,500 pa		
Caroma Industries Ltd	Up to $1000 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to Year 1 or Year 2 of the full-time degree course in Ceramic Engineering.
Fowlerware	Up to $500 pa		
Monier PGH Limited	Up to $1000 pa		
The Thomson Family	Up to $1000 pa		
Zacuba Pty Ltd	Up to $1500 pa		
Metallurgy			
Sir Rupert Myers	Up to $1500 pa	1 year renewable for the duration of the course subject to satisfactory progress	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 or Year 2 of the full-time degree course in Metallurgy or Metallurgical Engineering
Industrial Sponsors Program	Up to $1250 pa		
Comalco Research Award in Metallury	Up to $1500		Eligibility for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Process Engineering
Mines			
Applied Geology			
Renison Goldfields Consolidated	$5000 pa	1 year	Permanent residence in Australia and enrolled in Year 4 of the Applied Geology course, or equivalent Science and Mathematics (honours) course

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Applied Science (continued)			
Mining Engineering			
Stan Sawyer Memorial Scholarship to Coal Mining Students	Up to $200 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Eligibility for admission to Year 3 or Year 4 of the full-time degree course in Mining Engineering
School of Mines			
The Charles Warman Scholarship	$4000 pa	1 year	Permanent residence in Australia and enrolled in any year of the full-time degree course in Mineral Engineering
Joint Coal Board Scholarship	$500	1 year	Enrolled in Year 4 of Geology, Mineral Engineering or Mining Engineering course. Selection is based on academic merit.

The UNSW Co-op Program

The University of New South Wales has industry-linked education scholarship programs to the value of $8000 per annum in the following areas: Business Information Technology, Chemical Engineering, Civil Engineering, Electrical and Computer Engineering, Industrial Chemistry, Mechanical and Industrial Engineering, Mining, Mineral Engineering and Applied Geology. Further information can be obtained by writing to The Co-ordinator, UNSW Co-op Programs Industry-Linked Education Office, C/- Vice-Chancellors Division.

Graduate Scholarships

Application forms and further information are available from the Student Centre, located on the Ground Floor of the Chancellery unless an alternative contact address is provided. Information is also available on additional scholarships which may become available from time to time, mainly from funds provided by organizations sponsoring research projects.

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;* **3.** *Scholarships Guide for Commonwealth Postgraduate Students*, published by the Association of Commonwealth Universities.*

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.

*Available for reference in the University Library.

Donor	Value	Year/s of Tenure	Conditions
General			
University Postgraduate Research Scholarships	Living allowance of $13,504 pa. Other allowances may also be paid. Tax free.	1-2 years for a Masters and 3-4 years for a PhD degree	Applicants must be honours graduates or equivalent. Applications to Dean of relevant Faculty.
Commonwealth Postgraduate Research Awards	$13,504 to $17,427		Applicants must be honours graduates or equivalent or scholars who will graduate with honours in current academic year, and who are domiciled in Australia. Applications to Registrar by 31 October.
Commonwealth Postgraduate Course Awards	Living allowance of $10,903 pa. Other allowances may also be paid. Tax free.	1-2 years; minimum duration of course	Applicants must be graduates or scholars who will graduate in current academic year, and who have not previously held a Commonwealth Post-graduate Award. Applicants must be domiciled in Australia. Preference is given to applicants with employment experience. Applications to the Registrar by 28 September.
Overseas Postgraduate Research Scholarships	Tuition fees only	2 years for a Masters and 3 years for a PhD	Eligibility is confined to postgraduate research studentgs who are citizens of overseas countries excluding citizens of countries which are covered by the Equity and Merit Scholarship Scheme (EMSS). Application to the Registrar by 28 September
IDP-Korea/Taiwan Research Scholarships	Tuition fees and a stipend	2 years for a Masters and 3 years for a PhD	Eligibility is confined to postgraduate research students who are citizens of Korea or Taiwan. Application to the Registrar by 31 July.
Australian American Educational Foundation Fulbright Award	Travel expenses and $A2000 as establishment allowance.	1 year, renewable	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.
Australian Federation of University Women	Amount varies, depending on award	Up to 1 year	Applicants must be female graduates who are members of the Australian Federation of University Women

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Commonwealth Scholarship and Fellowship Plan	Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.	Usually 2 years, sometimes 3	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 September or October each year.
The English-Speaking Union (NSW Branch)	$7000	1 year	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, Sydney School of Arts, 275c Pitt Street, Sydney NSW 2000.
Frank Knox Memorial Fellowships tenable at Harvard University	Stipend of $US7000 pa plus tuition fees	1, sometimes 2 years	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	Up to $US 15,000	1 year	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	$6000 pa. Under special circumstances this may be increased	2 years	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	Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA	12 to 21 months	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 36 years of age. Applications close 29 August 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	Living and travel allowances, tuition expenses.	1-3 years	Applicants must be Australian citizens who are honours graduates or equivalent, and under 26 years of age. Applications close 15 October with The Secretary, Cambridge Commonwealth Trust, PO Box 252, Cambridge CB2 ITZ, England.
The Rhodes Scholarship to Oxford University	Approximately 4862 stg pa	2 years, may be extended for a third year.	Unmarried Australian citizens aged between 19 and 25 who have an honours degree or equivalent. Applications close in August each year with The Secretary, University of Sydney, NSW 2006.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Applied Science			
Pig Research Council Study/Training Awards			Applications close 19 September with the Department of Primary Industry, Canberra ACT 2600.
Australian Wool Corporation Postgraduate Scholarships	$21,362 pa (taxable)	1 year subject to satisfactory progress. Renewable annually; maximum tenure of 2 years for a Masters candidate or 3 to 4 years for a PhD degree.	Tenable in Australian tertiary institutions or overseas in exceptional circumstances. Enquiries to the School of Fibre Science and Technology.
Australian Meat and Live-stock Research and Development Corporation	$8,882 pa	1-3 years varies with course	Awarded for graduate study of the industry leading to the award of a diploma, or Masters or PhD degree. Tenable in Australia or overseas. Applications close 31 July with the AMLRD Corporation, PO Box A498, Sydney South NSW 2000.
Water Industry Research Award	$21000 pa	2-4 years	Applications close with the Registrar 20 June.

Prizes

Undergraduate University Prizes

The following table summarizes the 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 or the Chancellery.

Donor/Name of Prize	Value $	Awarded for
General		
The Sydney Technical College Union Award	$400.00 and Bronze Medal	Leadership in student affairs combined with marked academic proficiency by a graduand.
The University of New South Wales Alumni Association Prize	Statuette	Achievement for community benefit by a student in the final or graduating year.
School of Applied Bioscience - Department of Food Science and Technology		
The Cottee's Foods Prize	$500.00	The best performance in FOOD1420 Food Leglislation in the Bachelor of Science in Food Technology course.
The Wilfred B.S. Bishop Prize	$75.00	The best overall performance in the Bachelor of Science Degree in Food Technology course by a student who has made a significant contribution to staff and student activities.
The Nestle' Australia Pty Limited Prize	$200.00	The best performance in ABIO1400 Project in the Bachelor of Science in Food Technology course
School of Applied Bioscience - Department of Biotechnology		
The Burns Philp Food Prize	$175.00	The best performance in BIOT3100 Fermentation Processes in the Bachelor of Science course
The Burns Philp Food Prize	$175.00	The best performance in one of the Level 3 Biotechnology subjects BIOT3011 Biotechnology A BIOT3021 Biotechnology B BIOT3031 Microbial Genetics by a student in the Bachelor of Science course
The Burns Philp Food Prize	$175.00	The best overall performance in the Bachelor of Science (Biotechnology) Honours course
School of Fibre Science and Technology - Department of Textile Technology		
The J.B. Speakman Prize	$50.00	The best undergraduate thesis in the final year of the Bachelor of Science course in Textile Technology or Textile Management.
The R.J. Webster Prize	$250.00	The best performance throughout the Bachelor of Science course in Textile Technology or Textile Management.
The Textile Institute Prize	Two years free membership of the Textile Institute	The best performance in textile technology subjects by a student in the Bachelor of Science course in Textile Technology or Textile Management.

School of Fibre Science and Technology - Department of Wool and Animal Science

The Bayer Animal Health Prize	$120.00	The best performance in Years 2 and Year 3 of a Degree course in Wool Science
The C.R. Luckock Prize	Book or $60.00 voucher drawn on Uni.Co-op Bookshop	The best performance in Meat Science in the Department of Wool and Pastoral Sciences
The National Farmers' Federation Prize	$150.00	Excellent academic attainment by a graduating student in the Bachelor of Science in Wool and Pastoral Sciences
The Parkes Wool Promotion Committee Prize	A shield held in the Department of Wool and Aminal Science on which the name of the successful student is engraved each year	The best performance in Practical Wool Studies in the Department of Wool and Pastoral Sciences
The P.R. McMahon Memorial Prize	$100.00	Excellence in Wool Science in the Bachelor of Science course in Wool and Pastoral Sciences

School of Geography

The Jack Mabbutt Medal	Medal	The best performance in the Year 4 Project in Applied Geography by a student in the Bachelor of Science (Applied Science) course
The Jack Mabbutt Prize	$150.00	Best performance by a Year 3 student proceeding to Honours in Geography

School of Materials Science and Engineering

The Alcan Australia Ltd Prize	$200.00	The best performance in a subject selected by the Head of School
The Austral Crane Prize	$150.00	The best performance in a subject selected by the Head of School
The Australasian Corrosion Association (NSW)	$150.00	The best performance in MATS1203 Materials & Design 2 by a student in the Bachelor of Metallurgical Engineering course.
The Australian Ceramic Society Prize	$100.00	The highest overall course aggregate by a student completing the final year of the degree of Bachelor of Engineering in Ceramic Engineering
The Australian Welding Institute Prize	Books to the value of $60.00 + 1 years Membership of the Institute	The best performance in a subject selected by the Head of School
The Broken Hill Proprietory Company Prize	$1,000.00	The best performance in a subject selected by the Head of School
The Hugh Muir Prize	$275.00	The best performance by a student in the final year seminar class, who in the opinion of the Head of School has contributed most to the corporate life of the School of Materials Science and Engineering.
The Institute of Metals and Materials Australasia Prize	$200.00 and one years membership of the Institute	The best performance in a subject selected by the Head of School
The Max Hatherly Prize	$275.00	The best performance in the final year practical examination or for an outstanding performance in Metallography
The Wallarah Minerals Prize	$100.00	The best performance in an honours thesis by a student in the Bachelor of Engineering course in Ceramic Engineering.

The Western Mining Corporation Ltd Prize	$150.00	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	$150.00	The best overall performance in Year 4 full-time (or its part-time equivalent) in the Bachelor of Engineering (Metallurgical Process Engineering) or Bachelor of Science (Technology) courses in Materials Science and Engineering
The Z.C. Mines Prize	$200.00	The best performance in a subject selected by the Head of School

School of Mines

The Joint Coal Board Prize	$200.00	The best performance in Year 2 of the Bachelor of Engineering Course in Mining Engineering
The Joint Coal Board Prize	$200.00	The best performance in Year 3 of the Bachelor of Engineering course in Mining Engineering
The Joint Coal Board Prize	$300.00	The best overall performance in the Bachelor of Engineering course in Mining Engineering
The Western Mining Corporation Ltd Melbourne Prize	$200.00	The best overall performance by a student in the Bachelor of Engineering course in Mining Engineering
The Western Mining Corporation Ltd Perth Prize	$150.00	The best overall performance by a student in the final year of the Bachelor of Engineering course in Mining Engineering
The Western Mining Corporation Ltd Perth Prize	$150.00	The best overall performance by a student in Year 3 of the Bachelor of Engineering course in Mining Engineering

School of Mines - Department of Applied Geology

The Crae Mapping Prize in Applied Geology	$250.00	The best performance in GEOL3121 Earth Environments 2 - Geological Field Mapping Tutorial by a student in the Bachelor of Science course
The F.C. Loughnan Prize For First Year Geology	$100.00	The best performance in year 1 of the Geology component of the Bachelor of Science Course.
The F.C. Loughnan Prize in Applied Geology	$340.00	The best performance in Year 3 of the Geology component of the Bachelor of Science course.
The Prospectors Supplies Prize	Brunton Compass	Meritorious performance in GEOL4203 Field Project by a student in Year 4 of the Applied Geology Course, or equivalent Science & Mathematics (honours) course, proceeding to the degree of Bachelor of Science.

Graduate University Prizes

The following table summarizes the graduate prizes awarded by the University.

Donor/name of Prize	Value $	Awarded for

School of Applied Bioscience - Department of Biotechnology

The Burns Philp Foods Prize	$175.00	The best overall performance in the Master of Applied Science (Biotechnology) course.

School of Chemical Engineering and Industrial Chemistry

The Clean Air Society of Australia and New Zealand Prize in Atmospheric Pollution Control	$100.00	The Highest aggregate in FUEL5910 Atmospheric Pollution and Control and FUEL5920 Practical Aspects of Air Pollution Measurement and Control in a postgraduate course in the School of Chemical Engineering and Industrial Chemistry

School of Fibre Science and Technology - Department of Textile Technology

The Malcolm Chaikin Prize	$200.00 and Bronze Medal	The most outstanding Ph.D thesis in the Department of Textile Technology

School of Mines - Department Of Applied Geology

The Laric V. Hawkins Prize	$500.00	The best written account of research work in the area of Geophysics in a postgraduate degree or diploma course

Student's Timetable

Time	Monday		Tuesday		Wednesday		Thursday		Friday	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
9-10										
10-11										
11-12										
12-1										
1-2										
2-3										
3-4										
4-5										
5-6										
6-7										
7-8										
8-9										

Student's Timetable

Time	Monday		Tuesday		Wednesday		Thursday		Friday	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
9-10										
10-11										
11-12										
12-1										
1-2										
2-3										
3-4										
4-5										
5-6										
6-7										
7-8										
8-9										

Student's Timetable

Time	Monday		Tuesday		Wednesday		Thursday		Friday	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
9-10										
10-11										
11-12										
12-1										
1-2										
2-3										
3-4										
4-5										
5-6										
6-7										
7-8										
8-9										

The University of New South Wales Kensington Campus

Theatres

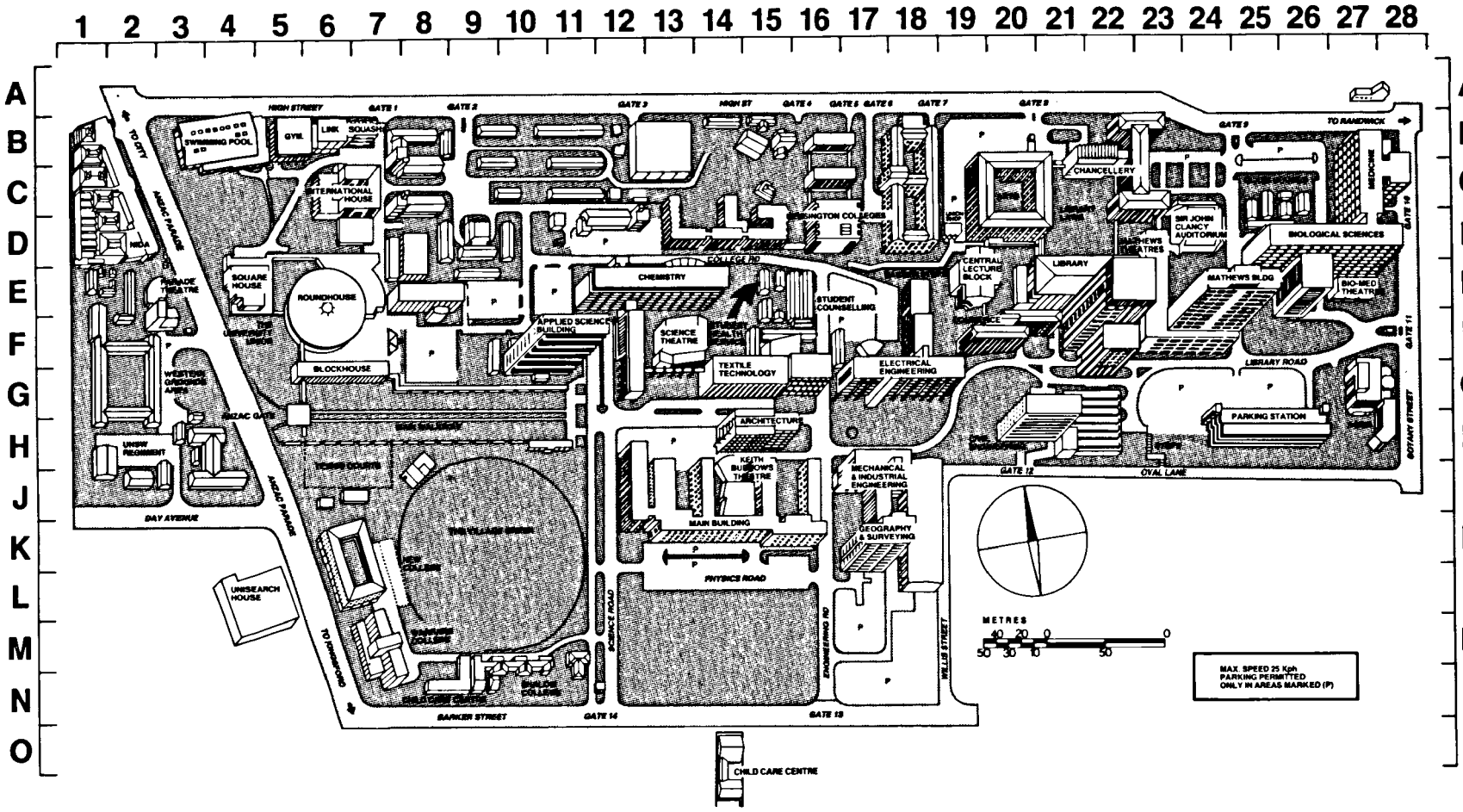
Biomedical Theatres **E27**
Central Lecture Block **E19**
Classroom Block (Western Grounds) **H3**
Rex Vowels Theatre **F17**
Keith Burrows Theatre **J14**
Main Building (Physics) Theatrette **K14**
Mathews Theatres **D23**
Parade Theatre **E3**
Science Theatre **F13**
Sir John Clancy Auditorium **C24**

Buildings

Affiliated Residential Colleges
New (Anglican) **L6**
Shalom (Jewish) **N9**
Warrane **M7**
Applied Science **F10**
Architecture **H14**
Arts (Morven Brown) **C20**
Banks **F22**
Barker Street Gatehouse **N11**
Basser College **C18**
Biological Sciences **D26**
Central Store **B13**
Chancellery **C22**
Chemistry (*Dalton*) **F12**
Robert Heffron **E12**
Civil Engineering **H20**
Commerce and Economics (John Goodsell) **F20**
Dalton (Chemistry) **F12**
Electrical Engineering **G17**
Geography and Surveying **K17**
Goldstein College **D16**
Golf House **A27**
Gymnasium **B5**
House at Pooh Corner **N8**
International House **C6**
Io Myers Studio **D9**
John Goodsell (Commerce and Economics) **F20**
Kanga's House **O14**
Kensington Colleges **C17** (Office)
Basser **C18**
Goldstein **D16**
Philip Baxter **D14**
Link **B6**
Maintenance Workshop **B13**
Materials Science and Engineering **E8**
Mathews **F23**
Mechanical and Industrial Engineering **J17**
Medicine (Administration) **B27**
Menzies Library **E21**
Morven Brown (Arts) **C20**
New College (Anglican) **L6**
Newton **J12**
NIDA **D2**
Parking Station **H25**
Philip Baxter College **D14**
Robert Heffron (Chemistry) **E12**
Sam Cracknell Pavilion **H8**
Shalom College (Jewish) **N9**
Sir Robert Webster (Textile Technology) **G14**
Wool & Animal Sciences **G14**
Squash Courts **B7**
Swimming Pool **B4**
Unisearch House **L5**
University Regiment **J2**
University Union (Roundhouse) – Stage I **E6**
University Union (Blockhouse) – Stage II **G6**
University Union (Squarehouse) – Stage III **E4**
Wallace Wurth School of Medicine **C27**
Warrane College **M7**

General

Accommodation (off-campus) **F15**
Academic Staff Office **C22**
Accounting **F20**
Admissions **C22**
Adviser for Prospective Students **C22**
Anatomy **C27**
Applied Economic Research **G14**
Applied Geology **F10**
Applied Science (Faculty Office) **F10**
Architecture (including Faculty Office) **H14**
Arts (Faculty Office) **C20**
Audio Visual Unit **F20**
Australian Graduate School of Management **G27**
Banking and Finance **F20**
Biochemistry **D26**
Biological and Behavioural Sciences (Faculty Office) **D26**
Biomedical Engineering **A28**
Biomedical Library **F23**
Biotechnology **D26**
Bookshop **G17**
Building **H14**
Careers and Employment **F15**
Cashier's Office **C22**
Chaplains **E15**
Chemical Engineering and Industrial Chemistry **F10**
Chemistry **E12**
Child Care Centres **N8, O14**
Civil Engineering **H20**
Commerce and Economics (Faculty Office) **F20**
Community Medicine **D26**
Computing Services Department **F21, D26**
Counselling and Careers Service **F15**
Economics **F20**
Education **G2**
Education Testing Centre **E15**
Electrical Engineering and Computer Science **G17**
Energy Research, Development and Information Centre **F10**
Engineering (Faculty Office) **K17**
English **C20**
Ethics Committees Secretariat **B8**
Examinations **C22**
Fees Office **C22**
Food Science and Technology **F10**
French **C20**
General Staff Office **C22**
Geography **K17**
German Studies **C20**
Graduate Office and Alumni Centre **E4**
Graduate School of the Built Environment **H14**
Groundwater Management and Hydrogeology **F10**
Health Services Management **C22**
History **C20**
Industrial Arts **H14**
Industrial Design **G15**
Industrial Relations and Organizational Behaviour **F20**
Information Systems **F20**
International Student Centre **F16**
IPACE **F23**
Kanga's House **O14**
Kindergarten (House at Pooh Corner) **N8**
Landscape Architecture **K15**
Law (Faculty Office) **F21**
Law Library **F21**
Legal Studies and Taxation **F20**
Liberal and General Studies **C20**
Librarianship **F23**
Library **E21**
Lost Property **C22**
Marine Science **D26**
Marketing **F20**
Materials Science and Engineering **E8**
Mathematics **F23**
Mechanical and Industrial Engineering **J17**
Medical Education **C27**
Medicine (Faculty Office) **B27**
Microbiology **D26**
Mineral Processing and Extractive Metallurgy **E8**
Mining Engineering **K15**
Music **B11**
National Institute of Dramatic Art **D2**
News Service **C22**
Optometry **J12**
Pathology **C27**
Patrol and Cleaning Services **C22**
Petroleum Engineering **D12**
Philosophy **C20**
Physics **K15**
Physiology and Pharmacology **C27**
Political Science **C20**
Printing Unit **C22**
Psychology **F23**
Publications Section **C22**
Remote Sensing **K17**
Russian Studies **C20**
Safety Science **J17**
Science and Mathematics Course Office **D26**
Science and Technology Studies **C20**
Social Work **G2**
Sociology **C20**
Spanish and Latin American Studies **C20**
Sport and Recreation Centre **B6**
University Health Services **E15**
Student Records **C22**
Student Services **F15**
Students' Union **E4** and **C21**
Surveying **K17**
Professional Development Centre **E15**
Textile Technology **G14**
Theatre Studies **B10**
Town Planning **K15**
Union Shop (Upper Campus) **D19**
University Archives **E21**
University Press **A28**
University Union (Blockhouse) **G6**
Waste Management **H20**
WHO Regional Training Centre **C27**
Wool & Animal Sciences **G14**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A B C D E F G H J K L M N O
HIGH STREET
GATE 1
GATE 2
GATE 3
HIGH ST
GATE 4
GATE 5
GATE 6
GATE 7
GATE 8
GATE 9
TO RANDWICK
TO CITY
ANZAC PARADE
SWIMMING POOL
GYM
LINK
SQUASH
INTERNATIONAL HOUSE
KENSINGTON COLLEGES
CHANCELLERY
MEDICINE
NIDA
PARADE THEATRE
SQUARE HOUSE
ROUNDHOUSE
CHEMISTRY
COLLEGE RD
APPLIED SCIENCE BUILDING
SCIENCE THEATRE
STUDENT COUNSELLING
CENTRAL LECTURE BLOCK
LIBRARY
SIR JOHN CLANCY AUDITORIUM
MATHEWS THEATRES
BIOLOGICAL SCIENCES
MATHEWS BLDG
BIO-MED THEATRE
GATE 10
GATE 11
BLOCKHOUSE
TEXTILE TECHNOLOGY
ELECTRICAL ENGINEERING
LIBRARY ROAD
PARKING STATION
BOTANY STREET
WESTERN GARRISON ARMS
ANZAC GATE
ARCHITECTURE
KEITH BURROWS THEATRE
MECHANICAL & INDUSTRIAL ENGINEERING
GEOGRAPHY & SURVEYING
GATE 12
OVAL LANE
DAY AVENUE
MAIN BUILDING
PHYSICS ROAD
UNISEARCH HOUSE
TO TOWNSEND
ANZAC ROAD
ENGINEERING RD
WILLIS STREET
METRES
40 20 0 0
50 30 0 50
MAX. SPEED 25 Kph
PARKING PERMITTED
ONLY IN AREAS MARKED (P)
BARKER STREET
GATE 14
GATE 15
CHILD CARE CENTRE

This Handbook has been specifically designed as a source of reference for you and will prove useful for consultation throughout the year.

For fuller details about the University – its organization, staff membership, description of disciplines, scholarships, prizes, and so on, you should consult the Calendar.

The Calendar and Handbooks also contain a summary list of higher degrees as well as the conditions for their award applicable to each volume.

For detailed information about courses, subjects and requirements of a particular faculty you should consult the relevant Faculty Handbook.

Separate Handbooks are published for the Faculties of Applied Science, Architecture, Arts, Commerce and Economics, Engineering, Law, Medicine, Professional Studies, Science (including Biological and Behavioural Sciences and the Board of Studies in Science and Mathematics), and the Australian Graduate School of Management (AGSM).

The Calendar and Handbooks, which vary in cost, are available from the Cashier's Office.