The University of New South Wales

Applied Science

1987 Faculty Handbook

How to use this Handbook

The information in this book has been divided into **nine parts.**

General Information (pages 1-24) lists what you need to know about the University as a whole, introduces some of the services available and notes the most important rules and procedures. You should read this part in its entirety.

For further information about the University and its activities, see the University Calendar.

Faculty Information.

Undergraduate Study outlines the courses available in each school in the faculty.

Undergraduate Study: Subject Descriptions lists each subject offered by the schools in the faculty. The schools are listed numerically.

Information includes:

- Subject number, title and description
- Prerequisite, co-requisite and excluded subjects, where applicable
- Additional information about the subject such as credit value, class contact or teaching hours per week, sessions when taught

Graduate Study is about higher degrees.

Graduate Study: Subject Descriptions lists each subject offered by the schools in the faculty. The schools are listed numerically.

Information included is as for **Undergraduate Study: Subject Descriptions,** above.

Conditions for the Award of Higher Degrees.

Scholarships and Prizes available at undergraduate and graduate level in the faculty.

Staff list.

For detailed reference, see the list of **Contents.**

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Applied Science

1987 Faculty Handbook

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New South Wales is:

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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 September 1986, but may be amended without notice by the University Council.

Contents

General Information

To obtain the maximum benefit from your studies you should make an effort to learn what facilities the University offers, to investigate the best methods of study and to discover as much as possible about the course for which you are enrolled.

This Handbook has been specially designed as a detailed source of reference for you in all matters related to your Faculty. This **General Information** Section is intended to help you put the Faculty into perspective with the University as a whole, to introduce you to some of the services available to students and to note some of the most important rules and procedures.

For fuller details about some aspects of the University and its activities you might need to consult the University Calendar.

Note: All phone numbers below are University extension numbers. If you are outside the University, dial 697 2222 and ask for the extension. Alternatively you may dial 697 and then the extension number. This prefix should only be used when you are certain of the extension that you require as callers using 697 cannot be transferred to any other number.

Some people who can help you

If you are experiencing difficulties in adjusting to the requirements of the University you will probably need advice. The best people to talk to on matters relating to progress in studies are your tutors and lecturers. If your problem lies outside this area there are many other people with specialized knowledge and skills who may be able to help you.

The **Student Services** staff, located on the ground floor of the Chancellery, will help those students who need advice and who have problems but who do not seem to be provided for by the other organizations and services mentioned. As well as dealing with general enquiries the staff is especially concerned with the problems of overseas, Aboriginal, and physically handicapped and disabled students. Enquire at Room G19, phone 3114.

The **Senior Assistant Registrar (Student Administration)**, Ms Judith Tonkin, is located on the ground floor of the Chancellery. For particular enquiries regarding illness and other matters affecting performance in examinations and assessment, graduation ceremonies, release of examination results and variations to enrolment programs, phone 3102 or 3097.

The **Assistant Registrar (Undergraduate Office)**, Mr John Beauchamp, is located on the ground floor of the Chancellery. General inquiries should be directed to 3095.

The **Senior Administrative Officer (Examinations)**, Mr John Grigg, is located on the ground floor of the Chancellery. Enquiries regarding examinations, including examination timetables and clash of examinations should be directed to 3088.

The **Adviser for Prospective Students**, Mrs Fay Lindsay, is located with the Careers and Employment Section and is

available for personal interview. For an appointment phone 5434.

The **Careers and Employment Section** is located in Hut E15c at the foot of Basser Steps. Enquiries should be directed to 5430.

The **Off-campus Housing Service** is located in Room G19 in the Chancellery. For assistance in obtaining suitable accommodation phone 3116.

Student Loans enquiries should be directed to Room G19 in the Chancellery, phone 3115.

The **Student Health Unit** is located in Hut E15b at the foot of Basser Steps. The Director is Dr Geoffrey Hansen. For medical aid phone 5427, 5426 or 5425.

The **Student Counselling and Research Unit** is located at the foot of Basser Steps. Dr Pat Cleary is the Head of the Unit. For assistance with educational or vocational problems ring 5418 or 5422 for an appointment.

The **University Librarian** is Mr Allan Horton. Library enquiries should be directed to 2686.

The **Chaplaincy Centre** is located in Hut E15a at the foot of Basser Steps.

The **Students' Union** has two offices on campus. One is located at the back of the Library Lawn (between the Chancellery and the Morven Brown Building), where the SU President, Education Vice President, Education Officer, Clubs and Societies Secretary and Postgraduate Officer are available to discuss student problems. The other is on the second floor of the Squarehouse, where the Secretary/Treasurer, Women's Officer, Overseas Student Director, the full-time Solicitor, *Tharunka* and *Campuswide* provide information and student services.

Cashier's Hours The University Cashier's office is open from 9.30 am to 1.00 pm and from 2.00 pm to 4.30 pm, Monday to Friday. It is open for additional periods at the beginning of Session 1. Consult noticeboards for details.

Calendar of Dates

The Academic Year

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

Session 1 commences on the first Monday of March.

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Faculties other than Medicine

Session 1 (14 weeks)	2 March to 10 May *May Recess: 11 May to 17 May* 18 May to 14 June *Study Recess: 15 June to 21 June* *Midyear Recess: 22 June to 26 July*
Examinations	22 June to 8 July
Session 2 (14 weeks)	27 July to 23 August *August Recess: 24 August to 30 August* 31 August to 8 November *Study Recess: 9 November to 15 November*
Examinations	16 November to 4 December

Faculty of Medicine

First and Second Years	As for other faculties
Third and Fourth Years	Term 1 (10 weeks) 19 January to 29 March
	Term 2 (9 weeks) 6 April to 10 May
	May Recess: 11 May to 17 May
	18 May to 14 June
	Term 3 (9 weeks) 22 June to 23 August
	August Recess: 24 August to 30 August
	Term 4 (10 weeks) 31 August to 8 November
Fifth Year	Term 1 (8 weeks) 19 January to 15 March
	Term 2 (8 weeks) 23 March to 17 May
	Term 3 (8 weeks) 25 May to 19 July
	Term 4 (8 weeks) 27 July to 20 September
	Term 5 (8 weeks) 28 September to 22 November

Australian Graduate School of Management

	Term 1 (10 weeks) 2 March to 8 May
	Term 2 (10 weeks) 1 June to 7 August
	Term 3 (10 weeks) 31 August to 7 November

University College/Australian Defence Force Academy

Session 1 (14 weeks)	2 March to 3 May *May Recess: 4 May to 17 May* 18 May to 19 June *Midyear Recess: 20 June to 12 July*
Examinations	22 June to 10 July

Session 2 (13 weeks)	13 July to 23 August *August Recess: 24 August to 6 September* 7 September to 23 October
Examinations	26 October to 13 November

January

Thursday 1	Public Holiday — New Year's Day
Monday 5	List of graduands in Medicine for February Graduation Ceremony published in *The Sydney Morning Herald*
Friday 9	Last day for acceptance of applications by office of the Admissions Section for transfer to another undergraduate course within the University
Monday 12	Last day for applications for review of results of assessment
Monday 26	Public Holiday — Australia Day

February

Monday 2	Enrolment period begins for second and later year undergraduate students and graduate students enrolled in formal courses
Tuesday 3	Enrolment period begins for new undergraduate students and undergraduate students repeating first year
Tuesday 24	Last day for undergraduate students who have completed requirements for pass degrees to advise the Registrar they are proceeding to an honours degree or do not wish to take out the degree for which they have applied for any other reason

March

Monday 2	**Session 1 begins** — all courses except Medicine III, IV and V
Wednesday 4	List of graduands for April/May ceremonies and 1984 prizewinners published in *The Sydney Morning Herald*
Monday 9	*Last day for notification of correction of details published in The Sydney Morning Herald* on 4 March concerning April/May graduation ceremonies
Friday 13	Last day for acceptance of enrolment by new undergraduate students and re-enrolling undergraduate students (late fee payable thereafter)

April

Thursday 16	Last day for undergraduate students to discontinue without failure subjects which extend over Session 1 only
Friday 17	Good Friday — Public Holiday
Saturday 18	Easter Saturday — Public Holiday
Monday 20	Easter Monday — Public Holiday
Saturday 25	Anzac Day — Public Holiday
Wednesday 29	*Confirmation of Enrolment* forms despatched to all students

May

Friday 8	Last day for acceptance of corrected *Confirmation of Enrolment* forms
Monday 11	**May Recess begins**
Wednesday 13	Last day for undergraduate students completing requirements for degrees at the end of Session 1 to submit *Application for Admission to Degree* forms
Thursday 14	Publication of provisional timetable for June/July examinations
Sunday 17	**May Recess ends**
Friday 22	Last day for students to advise of examination clashes

June

Tuesday 2	Publication of timetable for June/July examinations
Monday 8	Queen's Birthday — Public Holiday
Sunday 14	**Session 1 ends**
Monday 15	**Study Recess begins**
Sunday 21	**Study Recess ends**
Monday 22	**Midyear Recess begins**
	Examinations begin

July

Wednesday 8	Examinations end
Monday 20	Assessment results mailed to students

Tuesday 21	Assessment results displayed on University noticeboards *To Friday 24 July:* Students to amend enrolment programs following receipt of June examination results
Sunday 26	**Midyear Recess ends**
Monday 27	**Session 2 begins**
August	
Friday 7	Last day for students to discontinue without failure subjects which extend over the whole academic year
Monday 24	**August Recess begins**
Tuesday 25	Last day for undergraduate students who have completed requirements for pass degrees to advise the Registrar they are proceeding to an honours degree or do not wish to take out the degree for which they have applied for any other reason
Sunday 30	**August Recess ends**
September	
Wednesday 2	List of graduands for October graduation ceremonies published in *The Sydney Morning Herald*
Monday 7	*Last day for notification of correction of details published in The Sydney Morning Herald* on 2 September concerning October graduation ceremonies
Friday 18	Last day for undergraduate students to discontinue without failure subjects which extend over Session 2 only
Monday 28	*Confirmation of Enrolment* forms despatched to all students
Tuesday 29	Last day to apply to UCAC for transfer to another tertiary institution in New South Wales
October	
Monday 5	Eight Hour Day — Public Holiday
Wednesday 7	Last day for acceptance of corrected *Confirmation of Enrolment* forms
Thursday 8	Publication of provisional examination timetable
Friday 9	Last day for applications from undergraduate students completing requirements for degrees at the end of Session 2 to submit applications for *Admission to Degree* forms
Friday 16	Last day for students to advise of examination timetable clashes
Thursday 29	Publication of timetable for November examinations.
November	
Sunday 8	**Session 2 ends**
Monday 9	**Study Recess begins**
Sunday 15	**Study Recess ends**
Monday 16	**Examinations begin**
December	
Friday 4	Examinations end
Monday 21	Assessment results mailed to students
Tuesday 22	Assessment results displayed on University noticeboards
Friday 25	Christmas Day — Public Holiday
Monday 28	Boxing Day — Public Holiday

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Faculties other than Medicine

Session 1 **(14 weeks)**	7 March to 15 May
	May Recess: 16 May to 22 May 23 May to 19 June *Study Recess: 20 June to 26 June* *Midyear Recess: 27 June to 31 July*
Examinations	27 June to 13 July
Session 2 **(14 weeks)**	1 August to 28 August
	August Recess: 29 August to 4 September 5 September to 13 November
	Study Recess: 14 November to 20 November
Examinations	21 November to 9 December

Faculty of Medicine

First and Second Years	As for other faculties
Third and Fourth Years	Term 1 (10 weeks) 25 January to 3 April Term 2 (9 weeks) 11 April to 15 May *May Recess: 16 May to 22 May* 23 May to 19 June Term 3 (9 weeks) 27 June to 28 August *August Recess: 29 August to 4 September* Term 4 (10 weeks) 5 September to 13 November
Fifth Year	Term 1 (8 weeks) 25 January to 20 March Term 2 (8 weeks) 28 March to 22 May Term 3 (8 weeks) 30 May to 24 July Term 4 (8 weeks) 1 August to 25 September Term 5 (8 weeks) 5 October to 27 November

University College/Australian Defence Force Academy

Session 1 (14 weeks)	7 March to 8 May *May Recess: 9 May to 22 May* 23 May to 24 June *Midyear Recess: 25 June to 17 July*
Examinations	27 June to 15 July
Session 2 (13 weeks)	18 July to 28 August *August Recess: 29 August to 11 September* 12 September to 28 October
Examinations	31 October to 18 November

Australian Graduate School of Management

Term 1 (10 weeks) 7 March to 13 May

Term 2 (10 weeks) 6 June to 12 August

Term 3 (10 weeks) 5 September to 11 November

January

Friday 1	Public Holiday (New Year)
Friday 8	Last day for acceptance of applications by office of the Admissions Section for transfer to another undergraduate course within the University
Monday 11	Last day for applications for review of results of annual examinations
Tuesday 26	Australia Day — Public Holiday

February

Monday 1	Enrolment period begins for second and later year undergraduate students and graduate students enrolled in formal courses

March

Monday 7	Session 1 begins — all courses except Medicine III, IV and V

April

Friday 1 to Monday 4	Easter—Public Holiday
Monday 25	Anzac Day — Public Holiday

Organization of the University

The University of New South Wales was first incorporated by an Act of Parliament in 1949, under the name of the New South Wales University of Technology.

In 1986 the University had 18,950 students and over 4,050 staff who worked in more than eighty buildings.

Arms of the University of New South Wales

The arms of the University are reproduced on the front cover of this handbook. The arms were granted by the College of Heralds in London, on 3 March 1952, and the heraldic description is as follows:

'Argent on a Cross Gules a Lion passant guardant between four Mullets of eight points Or a Chief Sable charged with an open Book proper thereon the word SCIENTIA in letters also Sable.

'The lion and the four stars of the Southern Cross on the Cross of St George have reference to the State of New South Wales which brought the University into being; the open book with SCIENTIA across its page reminds us of its original purpose. Beneath the shield is the motto 'Manu et Mente', ('with Hand and Mind') which is the motto of the Sydney Technical College, from which the University has developed. The motto is not an integral part of the Grant of Arms and could be changed at will; but it was the opinion of the University Council that the relationship with the parent institution should in some way be recorded.'

The University Colours

The colours of the University are black and gold.

The Council

The chief governing body of the University is the Council which has the responsibility of making all major decisions regarding its policy, conduct and welfare.

The Council consists of 29 members including parliamentary and ex officio members, members elected by the staff, students and graduates of the University and some appointed by the Minister for Education.

The Council meets at least five times per year and its members also serve on special committees dealing with, for example, academic matters, finance, buildings and equipment, personnel matters, student affairs and public relations.

The Chairman of the Council is the Chancellor, the Hon. Mr Justice Samuels.

The Professorial Board

The Professorial Board is one of the two chief academic bodies within the University and includes all the professors from the various faculties, non-professorial Heads of Schools and Chairmen of Faculty, and several ex-officio and appointed members. It deliberates on all questions such as matriculation requirements, the content of courses, the arrangement of syllabuses, the appointment of examiners and the conditions for graduate degrees. Its recommendations on matters of major policy are presented to Council for its consideration and adoption.

The Faculties/Boards of Studies

The executive head of a faculty or board of studies is the dean, with the exception of the Australian Graduate School of Management, where the executive head is the director. Members of each faculty or board meet regularly to consider matters pertaining to their own areas of teaching and research, the result of their deliberations being then submitted to the Professorial Board.

The term 'faculty' is used in two distinct senses in the University. Sometimes it is used to refer to the group of schools comprising the faculty, and at others to the deliberative body of academic members of the Schools within the faculty.

The ten faculties are Applied Science, Architecture, Arts, Biological Sciences, Commerce, Engineering, Law, Medicine, Professional Studies and Science. In addition, the Board of Studies of the Australian Graduate School of Management (AGSM), the Board of Studies in General Education and the Academic Board of the University College, Australian Defence Force Academy fulfil a function similar to that of the faculties. The Board of Studies in Science and Mathematics, which was established to facilitate the joint academic administration of the Science and Mathematics degree course by the faculties of Biological Sciences and Science, considers and reports to the Professorial Board on all matters relating to studies, lectures and examinations in the undergraduate courses offered by the Faculties of Biological Science and Science.

The Schools

Subjects come under the control of the individual schools (eg the School of Chemistry, the School of Accountancy). The head of the school in which you are studying is the person in this academic structure with whom you will be most directly concerned.

Executive Officers

As chief executive officer of the University, the Vice-Chancellor and Principal, Professor Michael Birt, is charged with managing and supervising the administrative, financial and other activities of the University.

He is assisted in this task by two Pro-Vice-Chancellors, together with the Deans and the two heads of the administrative divisions.

General Administration

The administrative work of the University is divided between the Deputy Principal (Administration) who is responsible for registrarial, property and staffing matters and the Deputy Principal (Planning and Information) who is responsible for planning information and analysis, finance and the provision of computing services.

Student Representation on Council and Faculties/Boards

Three members of the University Council may be students elected by students. All students who are not full-time members of staff are eligible to stand for a two-year term of office. The students who are elected to the Council are eligible for election to the committees of Council.

Students proceeding to a degree or a graduate diploma may elect members for appointment by the Council to their faculty or board of studies. Elections are for a one-year term of office.

Open Faculty/Board Meetings

If you wish you may attend a faculty or board meeting. You should seek advice at the office of the faculty whose meeting you wish to attend.

Award of the University Medal

The University may award a bronze medal to undergraduate students who have achieved highly distinguished merit throughout their degree course.

Identification of Subjects by Numbers

For information concerning the identifying number of each subject taught in each faculty as well as the full list of identifying numbers and subjects taught in the University, turn to the first page of the section **Subject Descriptions**. This list is also published in the Calendar.

Textbook Lists

Textbook lists are issued early in the year and are available from School and Faculty offices for re-enrolling students and from the Unisearch House Enrolment Centre for first year students.

Textbook Costs and Course-Related Costs

Students should allow quite a substantial sum for textbooks. This can vary from $250 to $600 per year depending on the course taken. These figures are based on the cost of new books. The Students' Union operates a secondhand bookshop.

Information about special equipment costs, accommodation charges and cost of subsistence on excursions, field work, etc, and for hospital residence (medical students) is available from individual schools.

Co-operative Bookshop

Membership is open to all members of the community, on initial payment of a fee of $12, refundable after 2 years.

General Studies Program

Almost all undergraduates in faculties other than Arts and Law are required to complete a General Studies program. The Department of General Studies within the Board of Studies in General Education publishes its own Handbook which is available free of charge. All enquiries about General Studies should

be made to the General Studies Office, Room G56, Morven Brown Building, phone 2436.

Student Services and Activities

Accommodation

Residential Colleges

There are seven residential colleges on campus. Each college offers accommodation in a distinctive environment which varies from college to college, as do facilities and fees. A brief description of each college is given below, and further information may be obtained directly from the individual colleges. In addition to basic residence fees, most colleges make minor additional charges for such items as registration fees, caution money or power charges. Intending students should lodge applications before the end of October in the year prior to the one in which they seek admission. Most colleges require a personal interview as part of the application procedure.

The Kensington Colleges

The Kensington Colleges comprise Basser College, Goldstein College and Philip Baxter College. They house 423 men and women students, as well as tutorial and administrative staff members. College life is maintained in an atmosphere which emphasises co-operation, academic purpose and mutual respect. Apply in writing to the Master, PO Box 24, Kensington, NSW 2033.

International House

International House accommodates 154 male or female students from Australia and up to thirty other countries. Generally about 30 disciplines are represented. College life is multicultural and multidisciplinary. Eight tutors are available to help students. Apply in writing to the Warden, International House, PO Box 1, Kensington, NSW 2033.

New College

New College is an Anglican college and it provides accommodation (with all meals) for 210 graduates and under-graduates, without regard to race, religion, or sex. The College, which has its own resident tutors and a Senior Resident Academic Fellow, sponsors a wide range of activities for staff and students of the University and encourages inter-disciplinary discussion. Apply to the Master, New College, Anzac Parade, Kensington 2033 (telephone 662 6066).

Shalom College

Shalom College is a Jewish residential college. It provides accommodation for 86 men and women students. Non-resident membership is available to students who wish to avail themselves of the Kosher dining room and tutorial facilities. Fees are payable on a session basis. Conferences are catered for, particularly with Kosher requirements. Rates are available on application. Apply in writing to the Master, Shalom College, the University of New South Wales, PO Box 1, Kensington, NSW 2033.

Warrane College

Warrane College offers accommodation for 180 men of all ages, backgrounds and beliefs. Excellent study conditions and a comprehensive tutorial program are features of College life. These are set in the context of a wide range of cultural, social, spiritual and sporting activities in a friendly and open atmosphere. Non-resident membership of the College is available. Opus Dei, a prelature of the Catholic Church, is responsible for the spiritual care of the College. Enquiries: The Master, Warrane College, PO Box 123 Kensington 2033. Telephone (02) 662 6199.

Creston Residence

Creston Residence offers accommodation to 25 undergraduate and graduate women students. Activities and tutorials are open to non-resident students. The activities of a spiritual nature are entrusted to Opus Dei, a personal prelature of the Catholic Church. Enquiries: 36 High Street, Randwick 2031. Telephone (02) 398 5693.

Other Accommodation

Off-campus Accommodation

Students requiring other than College accommodation may seek assistance in Room G19, the Chancellery, in obtaining suitable accommodation in the way of rooms with cooking facilities, flats, houses, share flats, etc. Extensive listings of all varieties of housing are kept up-to-date throughout the year and during vacations. Accommodation in the immediate vicinity of the University is not usually easy to find at short notice, and is expensive.

No appointment is necessary but there may be some delay in February and March. The Housing staff are always happy to discuss any aspect of accommodation.

Associations, Clubs and Societies

The Sports Association

The Sports Association is a student organization within the University which caters for a variety of sports for both men and women. In December 1952 the University Council approved the establishment of the Sports Association, which then consisted of five clubs. As the University has grown the Association has expanded, and it now includes thirty-seven clubs.

The Association office is situated in the Link Building, B6, lower campus, and can be contacted on extension 4880. The control of the Association is vested in the General Committee which includes delegates from all the clubs.

Membership is compulsory for all registered students, and the annual fee is as set out later, in **Rules and Procedures, Enrolment Procedures and Fees Schedules, section 15. Fees.** Membership is also open to all members of staff and graduates of the University on payment of a fee as prescribed in the By-laws of the Association. All members are

invited to take part in any of the activities arranged by the Association, and to make use of the University's sporting and recreational facilities.

The Association is affiliated with the Australian Universities Sports Association (AUSA) which is the controlling body for sport in all Australian universities.

Australian Armed Services

The University maintains links with the Royal Australian Navy, the Australian Army Reserve and the Royal Australian Air Force, and opportunities exist for student participation in their activities.

Chaplaincy Centre

The University Chapel

The University provides a small chapel for the use of all faiths. In its temporary housing it is located in Hut E15a near the Chemistry Building. The chapel is available for services of worship by arrangement with the full-time chaplains. At other times it is available for private meditation to all members of the University.

Chaplaincy Service

A Chaplaincy Service is available within the University of New South Wales for the benefit of students and staff.

The service offers fellowship, personal counselling and guidance, together with leadership and biblical and doctrinal studies and in worship. The chaplains maintain close liaison with student religious societies.

The chaplains are located in Hut E15a at the foot of Basser steps, which also contains the temporary chapel.

Student Services

The Student Services staff, located on the ground floor of the Chancellery, will help those students who have problems and need advice but who do not seem to be provided for by the other organizations and services mentioned. As well as dealing with those enquiries and with off-campus housing and student loan matters, they are especially concerned with the problems of physically handicapped and disabled students, overseas students, and aboriginal students.

All enquiries should be made either at Room G19 or by telephoning 697 3111.

Sport and Recreation Section

The Sport and Recreation Section seeks ways to encourage students and staff to include exercise as an essential part of their daily lives. It does this through Sports Clubs on a competitive basis and by offering physical recreation on a more casual basis to the University community.

The Section serves the Sports Association and its thirty-seven constituent clubs and is responsible for the continuing management of the Physical Education and Recreation Centre at which recreational programs are available for both students and staff.

It makes bookings for use of sporting facilities including tennis courts and playing fields. This section is located in the Link Building, B6, lower campus. The various services may be contacted by telephoning Recreation Program 697 4884; Grounds Bookings 697 4878; Tennis Bookings 697 4877; Sports Association 697 4880.

Physical Education and Recreation Centre

The Sport and Recreation Section provides a recreational program for students and staff at the Physical Education and Recreation Centre. The Centre consists of eight squash courts, seven tennis courts, a main building, a 50-metre indoor heated swimming pool and a new three-storey 'Link Building'. The main building has a large gymnasium and practice rooms for fencing, table tennis, judo, weight-lifting, karate and jazz ballet, also a physical fitness testing room. The 'Link Building' between the gymnasium and squash courts provides three additional training rooms on the upper floors and administrative and control functions at ground floor level. The recreational program includes intramurals, teaching/coaching, camps. The Centre is located on the lower campus adjacent to High Street. The Supervisor of Physical Recreation may be contacted by telephoning 697 4884.

Student Counselling and Research Unit

The Student Counselling and Research Unit provides counselling services to students, prospective students, parents and other concerned persons.

Together with the Careers and Employment Section, the unit is located in the huts near the foot of Basser Steps (access from College Road or Engineering Road).

Appointments are offered throughout the academic year and during recesses between 8 am and 5 pm on week days (up to 6 pm on some evenings). A 'walk-in' service for short interviews is available between 9 am and 5 pm. Appointments may be made by telephoning 697 5418 between 9.00 am and 5.00 pm.

Counsellors offer assistance in planning, decision-making, problem solving, social and emotional development, and dealing with grievances. Group programs on such topics as study, tutorial and examination skills, stress management, communicating, and self-confidence are offered each session. Brochures are available from the receptionist.

Careers and Employment Section

The Careers and Employment Section provides careers advice and assistance in finding employment.

Assistance with careers and permanent employment opportunities includes: the regular mailing of a *Job Vacancy Bulletin* to

registered students and graduates, a Library, and a Campus Interview Program in which final year students have the opportunity to speak to employers regarding employment prospects.

Assistance is also provided in obtaining course-related employment during long vacations as required by undergraduates in Engineering and Applied Science.

Together with the Student Counselling and Research Unit, this section is located in the huts near the foot of Basser Steps (access from College Road or Engineering Road).

For further information, telephone 697 5430.

Student Health Unit

A student health clinic and first aid centre is situated within the University. The medical service although therapeutic is not intended to replace private or community health services. Thus, where chronic or continuing conditions are revealed or suspected the student may be referred to a private practitioner or to an appropriate hospital. The health service is not responsible for fees incurred in these instances. The service is confidential and students are encouraged to attend for advice on matters pertaining to health.

The service is available to all enrolled students by appointment, free of charge, between 9 am and 5 pm Mondays to Fridays. For staff members, immunizations are available, and first aid service in the case of injury or illness on the campus.

The centre is located in Hut E15b on the northern side of the campus in College Road at the foot of the Basser Steps.

Appointments may be made by calling at the centre or by telephoning 697 5425, 697 5426 or 697 5427 during the above hours.

The Family Planning Association of NSW conducts clinics at the Student Health Unit and at the adjacent Prince of Wales Hospital which are available for both staff and students. Appointments may be made for the Student Health Unit clinic by telephoning 588 2833 or for the Prince of Wales Hospital clinics by telephoning 399 0111.

The Students' Union

The Students' Union was formed in 1952 as an organization, duly recognized by the University Council, to represent the student body and to provide a central organization for the administration of student activities. In the words of its constitution 'The Students' Union is formed for the purpose of advancing the interests of University men and women, facilitating their general scientific and technical education, and fostering a University spirit among them'.

The Students' Union affords a recognized means of communication between the student body and the University administration, and represents its members in all matters affecting their interests. It aims to promote the cultural, educational and recreational life of the University and to encourage a permanent interest among graduates in the life and progress of student activities within the University. The Students' Union also makes representations to government and other bodies outside the University on behalf of its members.

Membership of the Students' Union is compulsory for all registered students of the University; the annual subscription for full-time and part-time students is set out later, in **Rules and Procedures, Enrolment and Procedures and Fees Schedules,** section **15. Fees.** Only those persons who were enrolled as Life Members prior to January 1 1985, shall retain such membership.

The Students' Union is governed by a Council consisting in the main of elected student representatives from the various faculties of the University. There are also representatives of the University Council, Life Members, the Staff Association and the Sports Association. The Council is elected annually in May-June.

The Students' Union has three full-time officers who are elected each year by popular ballot. They are the President, who is mainly the political figure-head of the Union; the Secretary/Treasurer, who organizes the smooth operation of the SU offices, keeps the membership rolls up to date, and oversees the financial operations; and the Women's Officer who represents women on campus and formulates, maintains and co-ordinates the Students' Union policy on women's affairs.

Other officers are the Education Vice-President, who works towards the implementation of Students' Union education policy; the Education Officer concerned with helping students with problems relating to TEAS, Show-Cause and other matters relevant to their courses; the Vice-President who ensures the efficient running of CASOC: and the Director of Overseas Students who deals with specific problems these students may encounter while in Australia.

The activities in which the Students' Union is involved include:

1. Publication of the Student Paper *Tharunka.*

2. Production of the student video program *Campuswide.*

3. A free legal service run by a qualified lawyer employed by the Students' Union Council.

4. The Secondhand Bookshop for cheap texts.

5. A child care centre, *House at Pooh Corner.*

6. CASOC (Clubs and Societies on Campus) which provides money from the SU for affiliated clubs and societies on campus.

7. A video service with access for students to equipment and advice.

8. A noticeboard for casual job vacancies.

9. Organization of orientation for new students.

The SU has two offices on campus. One is located at the back of the Library Lawn (between the Chancellery and the Morven Brown Building), where the SU President, Education Vice-President, Education Officer, Clubs and Societies Secretary and Postgraduate Officer are available to discuss student problems. The other is on the Second Floor of the Squarehouse (above the bar) at the bottom end of campus, where the Secretary/Treasurer, Women's Officer, Overseas Student Director, the full-time Solicitor, *Tharunka* and *Campuswide* provide information and student services.

The University Library

The University libraries are mostly situated on the upper campus. The library buildings house the Social Sciences and

Humanities Library on Level 4, the Physical Sciences Library on Level 7 and the Law Library on Level 8. The undergraduate collection is on Levels 3 and 4. The Biomedical Library is in the western end of the Mathews Building and is closely associated with libraries in the teaching hospitals of the University.

For details consult Faculty Information in the relevant Faculty Handbook.

There are also library services at other centres:

- The Water Reference Library situated at Manly Vale (telephone 948 0261) which is closely associated with the Physical Sciences Library.
- The library at the Australian Defence Force Academy, ACT, serving the Faculty of Military Studies.

Each library provides reference and lending services to staff and students and each of the libraries on the Kensington campus is open throughout the year during the day and evening periods. The exact hours of opening vary during the course of the academic year. For recorded hours of opening telephone 697 2687.

Staff and students normally use a machine-readable identification card to borrow from the University libraries.

The University Union

The University Union provides the amenities which students, staff and graduates require in their daily University life and thus facilitates their knowing and understanding one another through associations outside the lecture room, the library and other places of work.

The Union is housed in a range of buildings across the campus, principal among which are the Roundhouse, the Blockhouse and the Squarehouse located near the Anzac Parade entrance to the University. Membership of the Union is compuslory for all registered students and is open to all members of staff and graduates of the University.

The control of the Union is vested in the Board of Management whose Chief Executive Officer is the Warden.

The Union operates a licensed Bar and twelve Food Service points on the campus, providing services ranging from take-away snacks and cafeteria-type meals to an à la carte restaurant operation.

Shops run directly by the Union are the Logo Shop (University-crested gifts, mementoes and clothing), two newsagency/stationery shops, one stationery shop specializing in architecture requisites and an ice cream/confectionery shop. Other facilities operating within buildings occupied by the Union are banks, a credit union agency, hairdressers and a beauty salon, barber, delicatessen, casual clothing shop, pharmacy, dentist, optical dispensing and travel services.

Showers, meeting, games, music practice, reading, craft and dark rooms are provided as well as a Student Resource Area where photocopying, screen printing, stencil cutting and typewriter services and equipment hire are available.

The Union's cultural activities program encompasses creative leisure classes, lunch hour concerts and films, market days and exhibitions.

Further information on Union programs, activities and services is provided in the Annual Union Handbook and in the Creative Leisure Classes and Activities brochures published each session.

Student Membership of Faculties and Boards of Studies

The provisions for the appointment of student members to faculties and boards of studies, stated by resolutions of Council of 9 May 1977, 16 January 1978 and 9 July 1984 are:

1. A person who is not a student of the University shall be ineligible to be appointed as a member of a faculty under these rules.

For the purposes of these rules 'student' means a person who is enrolled as a candidate proceeding to a degree or diploma of the University.

2. Each faculty shall recommend to the Professorial Board for consideration and recommendation to the Council the number, or the formula for determining the number, of students eligible to be appointed as members of that faculty and may at any time recommend changes in such matters.

3. Each faculty may recommend to the Professorial Board for consideration and recommendation to the Council the creation of distinct and separate electorates for the appointment of students as members and may at any time recommend changes in such matters.

4. All elections referred to in this resolution shall be conducted annually by the Registrar or his nominee, who shall be the Returning Officer, in accordance with the provisions of this resolution and any other relevant resolution of the Council, on such a day, being either a day in April or a day in October, and at such places and during such hours and using such election machinery and method of counting as shall be agreed upon between the Registrar or his nominee and the Chairman of the relevant faculty.

5. Elections shall be by personal voting except that students registered as external students and those students not on campus because of course requirements shall be entitled to vote by post and shall be enabled to do so. The Registrar or his nominee in consultation with Chairman of the relevant faculty shall determine which students are so entitled.

6. The successful candidates in any election shall be appointed to their respective faculties by the Registrar or his nominee.

7. A person elected to be a member of a faculty under the provisions of this resolution shall be entitled to such membership for a term of twelve months either from the date of the declaration of the election result or from such other date as shall be agreed between the Registrar or his nominee and the Chairman of the relevant faculty save that such membership of a faculty shall not be retained on ceasing to be a student enrolled in the faculty which entitled election except that:

(1) a person who has ceased to be so enrolled by reason of having completed the course requirements between the time of election and the close of the period for which elected shall retain such membership for the full period, and

(2) a student who has been granted leave of absence from the University in order to carry out the duties of an appointment as a full-time salaried officer of the University Union, the Students' Union, or the Sports Association shall while occupying the office in question be deemed to be a student for the purpose of this resolution and shall retain such membership for the full period.

8. When a casual vacancy in the membership of a faculty occurs either by resignation or by virtue of the provisions of section **7.** above the Registrar shall submit to Council for consideration for appointment to the vacancy for the remainder of the period of membership the name of the candidate if any who polled the greatest number of votes of the unsuccessful candidates at the most recent election in the relevant electorate.

9. That where a casual vacancy occurring in student membership of faculties or boards of studies cannot be filled within the provisions of section **8.** above, the executive committee of any faculty or board of studies be empowered to nominate to the Vice-Chancellor a student or students for consideration of appointment by Council.

10. Any student enrolled at the date on which the nominations close for a course leading to a degree or diploma awarded in a faculty shall be entitled to be nominated for, to be elected for, and to vote in an election for, membership of that faculty in such electorates as may be provided for under section **3.** above.

11. Any student enrolled at the date on which nominations close for a course leading to degrees or diplomas awarded by several faculties shall be eligible in any year to be nominated for, to be elected for, and to vote in an election for, membership of each such faculty in such electorates as may be provided for under section **3.** above, provided that such a student shall not in any year be nominated for, be elected for, or vote in an election for, membership of a faculty unless enrolled in a subject controlled by that faculty in that year.

12. Any student enrolled at the date on which nominations close for a course which contains a General Studies component shall be entitled to be nominated for, to be elected for, and to vote in an election for, membership of the Board of Studies in General Education in such electorates as may be provided for under section **3.** above.

13. Any student enrolled at the date on which nominations close for the Science and Mathematics course (**3970**) shall be eligible to be nominated for, to be elected for, and to vote in an election for, membership of the Board of Studies in Science and Mathematics in such electorates as may be provided for under section **3.** above.

14. In the interpretation of these provisions the expression 'faculty' includes 'boards of studies'.

Electorates

Electorates for student membership of faculties and boards of studies were defined by Council resolution.

Faculty of Applied Science

Five members elected by and from the students of the Faculty.

Faculty of Architecture

Four members elected by and from the students of the Faculty.

Faculty of Arts

Six members elected by and from the students of the Faculty.

Faculty of Biological Sciences

(1) Two members elected by and from the graduate students of the Faculty.

(2) One member elected by and from the undergraduates of the Faculty.

In the event of insufficient nominations being received from either electorate, the vacant place(s) shall be filled by the candidate(s), if any, receiving the greatest number of votes of the unsuccessful candidate(s) in the other electorate of the Faculty.

Faculty of Commerce

One member for each 500 students elected by and from the students of the Faculty, with a minimum number of three members, including where possible at least one candidate registered for an undergraduate degree and at least one candidate registered for a graduate degree or diploma.

Faculty of Engineering

(1) Two members elected by and from the undergraduates of the School of Civil Engineering.

(2) Two members elected by and from the undergraduates of the School of Electrical Engineering and Computer Science.

(3) Two members elected by and from the undergraduates of the School of Mechanical and Industrial Engineering.

(4) Two members elected by and from the undergraduates of the School of Surveying.

(5) Two members elected by and from the graduate students of the Faculty.

Faculty of Law

One student member for every 200 registered students (or fraction thereof) or one student member for every ten full-time teachers on the Faculty (or fraction thereof), whichever is the greater, elected by and from the students of the Faculty.

Faculty of Medicine

(1) One member elected by and from the undergraduates in Year 1 of the Medicine course.

(2) One member elected by and from the undergraduates in Year 2 of the Medicine course.

(3) One member elected by and from the undergraduates in Year 3 of the Medicine course.

(4) One member elected by and from the undergraduates in Year 4 of the Medicine course and those students enrolled in the course leading to the award of the degree of BMedSc.

(5) One member elected by and from the undergraduates in Year 5 of the Medicine course and the graduate students of the Faculty.

Faculty of Professional Studies

(1) One member elected by and from the undergraduates in the School of Education.

(2) One member elected by and from the undergraduates in the School of Health Administration.

(3) One member elected by and from the undergraduates in the School of Social Work.

(4) One member elected by and from the graduate diploma students in the School of Education.

(5) One member elected by and from the graduate diploma students in the School of Health Administration, the School of Librarianship and the School of Social Work.

(6) One member elected by and from the graduate students, other than the graduate diploma students, in the School of Education.

(7) One member elected by and from the graduate students, other than the graduate diploma students, in the School of Health Administration, the School of Librarianship and the School of Social Work.

Faculty of Science

(1) Two members elected by and from the undergraduates in the Pure and Applied Chemistry degree course (3910) and the Optometry degree course (3950).

(2) One member elected by and from the graduate students of the Faculty.

Board of Studies in Science and Mathematics

Three members elected by and from the undergraduates in the Science and Mathematics course (3970).

Australian Graduate School of Management Board of Studies

(1) Two members elected by and from the students enrolled in either the MBA degree course.

(2) One member elected by and from the students enrolled for the degree of Doctor of Philosophy in the AGSM.

Australian Graduate School of Management Board of Management

One member elected by and from the higher degree students in the AGSM (elected for a calendar year).

The provision for retention of membership of faculties and boards by students who are appointed officers of the University Union, the Sports Association and the provisions for filling casual vacancies, *do not* apply to membership of the AGSM Board of Management.

Board of Studies in General Education

(1) One member elected by and from the graduate students of the Board of Studies.

(2) Three members elected by and from the undergraduates enrolled in courses containing a General Studies component.

Academic Board, University College, Australian Defence Force Academy

(1) One member elected by and from the undergraduates enrolled in the BA degree course.

(2) One member elected by and from the undergraduates enrolled in the BSc degree course.

(3) One member elected by and from the undergraduates enrolled in the BE degree course.

(4) One member elected by and from the graduate students of the University College.

Financial Assistance to Students

Tertiary Education Assistance Scheme

Under this scheme, which is financed by the Commonwealth Government, assistance is available for full-time study in approved courses, to students who are not bonded and who are permanent residents of Australia, subject to a means test on a non-competitive basis. The allowances paid are unlikely to be sufficient, even at the maximum rate, for all the living expenses of a student. Family help and/or income from vacation or spare-time work would also be needed.

Students in the following types of university courses are eligible for assistance:

- Undergraduate and graduate bachelor degree courses;
- Graduate diplomas;
- Approved combined bachelor degree courses;
- Masters qualifying courses (one year).

The rates of allowance and conditions for eligibility are set out in a booklet obtainable from the Commonwealth Department of Education.

It is most important that students advise the TEAS office if at any time they change or discontinue their study programs, as their eligibility for benefits might be affected.

Other Financial Assistance

In addition to the Tertiary Education Assistance Scheme financed by the Australian Government the following forms of assistance are available:

1. *Deferment of Payment of Fees* Deferments may be granted for a short period, usually one month, without the imposition of a late fee penalty, provided the deferment is requested prior to the due date for fee payments.

2. *Short Term Cash Loans* Donations from various sources have made funds available for urgent cash loans not exceeding $100. These loans are normally repayable within one month.

3. The Commonwealth Government has made funds available to the University to provide loans to students in financial difficulty. The loans are to provide for living allowances and other approved expenses associated with attendance at university. Students are required to enter into a formal agreement with the University to repay the loan. The University is unable to provide from the fund amounts large enough for all or even a major part of the living expenses of a student.

Students who are in extremely difficult financial circumstances may apply for assistance by way of a grant. In order to qualify for a grant a student must generally show that the financial difficulty has arisen from exceptional misfortune. Grants are rarely made.

The University has also been the recipient of donations from the Arthur T. George Foundation, started by Sir Arthur George and his family, for the endowment of a student loan fund.

In all cases assistance is limited to students with reasonable academic records and whose financial circumstances warrant assistance.

Enquiries about all forms of financial assistance should be made at the office of Student Services, Room G19, the Chancellery.

Financial Assistance to Aboriginal Students

Financial assistance is available to help Aboriginal students from the Commonwealth Government's Aboriginal Study Grant Scheme. Furthermore, Aboriginal students may apply for loans from the Student Loan Funds.

The University has also received a generous bequest from the estate of the late Alice Brooks Gange for the education of Australian aborigines within the University. Under the terms of this Bequest the Vice-Chancellor approved the establishment of a Centre for Aboriginal Students. This Centre, which began operating in 1985, provides support for Aboriginal students who are enrolled in the University and who wish to use the Centre and its resources. The Centre has a Resident Supervisor.

All enquiries relating to these matters should be made at the office of Student Services, Room G19, the Chancellery.

Rules and Procedures

The University, in common with other large organizations, has established rules and procedures which are designed for the benefit of all members of the University. In some cases there are penalties (eg fines or exclusion from examinations) for non-compliance. Any student who, after carefully reading the rules set out in the following pages, requires further information on their application should seek further advice, in the first instance, at the Student Enquiry Counter in the North Wing of the Chancellery Building.

General Conduct

The University has not considered it necessary to formulate a detailed code of rules relating to the general conduct of students. Enrolment as a student of the University, however, involves an undertaking to observe the regulations, by-laws and rules of the University, and to pay due regard to any instructions given by any officer of the University.

Appeals

Section 5(c) of Chapter III of the By-laws provides that 'Any person affected by a decision of any member of the Professorial Board (other than the Vice-Chancellor) in respect of breach of discipline or misconduct may appeal to the Vice-Chancellor, and in the case of disciplinary action by the Vice-Chancellor, whether on appeal or otherwise, to the Council'.

Admission and Enrolment

The Student Enquiry Counter, located near the Cashier in the Chancellery on the upper campus, provides information for students on admission requirements, undergraduate and graduate courses and enrolment procedures. Faculty handbooks and the Calendar may be purchased from the Cashier. The Enquiry Counter is open from 9 am to 1 pm and 2 pm to 5 pm, Monday to Friday. During enrolment it is also open on some evenings.

Information may be obtained here about admission to first year undergraduate courses, special admission, admission with advanced standing and admission on overseas qualifications. Applications are also received from students who wish to transfer from one course to another, resume their studies after an absence of twelve months or more, or seek any concession in relation to a course in which they are enrolled.
Applications for admission to undergraduate courses from students who do not satisfy the requirements for admission (see section on **Admission Requirements**) are referred by the Admissions Section to the Admissions Committee of the Professorial Board.

It is essential that the closing dates for lodgement of applications are adhered to. For further details see the section on **Enrolment Procedures and Fees.**

Students wishing to enrol as higher degree candidates should first consult the Head of the School in which they wish to study. An application is then lodged on a standard form and the Postgraduate Section, after obtaining a recommendation from the Head of School, refers the application to the appropriate Faculty or Board of Studies Higher Degree Committee.

An Adviser for Prospective Students, Mrs Fay Lindsay, is located in the huts near the foot of Basser Steps (access from Engineering Road), and is available for personal interview with those who require additional information about the University.

First Year Entry

Those seeking entry to first year courses in one or more of twenty-four tertiary institutions in the State including all universities are required to lodge a single application form with the Universities and Colleges Admissions Centre (GPO Box 7049, Sydney 2001). On the application form provision is made for applicants to indicate preferences for courses available in any one of the seven universities and the other tertiary institutions. Students are notified individually of the result of their applications and provided with information regarding the procedures to be followed in order to accept the offer of a place at this university. Enrolment is completed at the Enrolment Bureau, Unisearch House, 221 Anzac Parade, Kensington.

Deferment of First Year Enrolment

Students who have received an offer of a place may request deferment of enrolment for one year and will usually receive permission providing they do not enrol at another tertiary institution in that year.

First year students who enrol and subsequently discontinue without failure their whole course will be permitted to re-enrol the following year providing they do not enrol at another tertiary institution. They must confirm their intention to re-enrol by lodging an application with the Universities and Colleges Admissions Centre.

Admission Requirements

A candidate for any degree of Bachelor of the University must have qualified for matriculation.

In addition, candidates must be selected before being permitted to enrol in a course. In 1987 it is necessary for the University to limit the number of students enrolling in all undergraduate courses.

Matriculated student

A candidate who has satisfied the conditions for matriculation and for admission to a course of study shall be classed as a 'matriculated student of the University', after enrolment.

A person who has satisfactorily met the conditions for admission may be provided with a statement to that effect.

Special entry to the University

Special provisions apply to Aboriginal students, to older students and to those who may have suffered educational disadvantage.

For details see after Supplementary Provision for Matriculation in the following section.

Enrolment Procedures and Fees Schedules 1987

1. Introduction

All students, except those enrolling in graduate research degree courses (see sections **5.** and **6.** below), must lodge an authorized enrolment form with the Cashier either on the day the enrolling officer signs the form or on the day any required General Studies electives are approved.

All students, except those enrolling in graduate research degree courses and those exempted as set out in section **17.** below, should on that day also either pay the required fees or lodge an enrolment voucher or other appropriate authority.

Such vouchers and authorities are generally issued by the NSW Department of Education and the NSW Public Service. They are not always issued in time and students who expect to receive an enrolment voucher or other appropriate authority but have not done so should pay the student activities fees and arrange a refund later. Such vouchers and authorities are not the responsibility of the University and their late receipt is not to be assumed as automatically exempting a student from the requirements of enrolling and paying fees.

If a student is unable to pay the fees the enrolment form must still be lodged with the Cashier and the student will be issued with a 'nil' receipt. The student is then indebted to the University and must pay the fees by the end of the second week of the session for which enrolment is being effected.

Penalties apply if fees are paid after the time allowed (see section **16.** below) unless the student has obtained an extension of time (see section **13.** below) in which to pay fees from the Student Enquiry Counter, the Chancellery. Such an application must be made before the fee is due. Payment may be made through the mail, in which case it is important that the student number be given accurately. Cash should not be sent through the mail.

2. New Undergraduate Enrolments

Persons who are applying for entry in 1987 must lodge an application for selection with the Universities and Colleges Admissions Centre, GPO Box 7049, Sydney 2001, by 1 October 1986.

Those who are selected will be required to complete enrolment at a specified time before the start of Session 1. Compulsory student activities fees should be paid on the day.

In special circumstances, however, and provided class places are still available, students may be allowed to complete enrolment after the prescribed time.

Application forms and details of the application procedures may be obtained from the Student Enquiries Counter, Ground Floor, North Wing of the Chancellery Building.

3. Re-enrolment

See also sections **4.**, **6.** and **7.** below.

Students who are continuing courses (or returning after approved leave of absence) should enrol in accordance with the procedures set out in the current *Enrolment Procedures* booklet, available from the Student Enquiry Counter in the Chancellery and from School offices. Undergraduate students who have completed part of a course and have been absent without leave need to apply for entry through the Universities and Colleges Admissions Centre, GPO Box 7049, Sydney 2001, by 1 October 1986.

First year students who enrol and subsequently discontinue without failure their whole course will be permitted to re-enrol the following year providing they do not enrol at another tertiary institution. They must confirm their intention to re-enrol by lodging an application with the Universities and Colleges Admissions Centre.

4. Restrictions Upon Re-enrolling

Students who in 1986 have infringed the rules governing re-enrolment should not attempt to re-enrol in 1987 but should follow the written instructions they will receive from the Registrar in December 1986.

5. New Research Students

Students enrolling for the first time in graduate research degree courses will be advised by letter concerning the method of enrolment. Enrolment other than in accordance with the procedure set out in this letter will incur a penalty (see section **16.** below).

6. Re-enrolling Research Students

Students undertaking research degree courses (course codes 0-2999) will be re-enrolled automatically each year and sent an account for any fees due.

7. Submission of Project Report

Students undertaking formal masters degree courses (course codes 8000-9999) who at the commencement of Session 1 have completed all the work for a degree or diploma except for the submission of the relevant project report are required to re-enrol by the end of the second week of Session 1. Completion of enrolment after that time will incur a penalty (see section **16.** below).

Information about possible student activities fees exemption is set out in section **17.** (10) below.

8. Enrolments by Miscellaneous Students

Enrolments by Miscellaneous students are governed by the following rules:

(1) Enrolment in a particular subject or subjects as a miscellaneous student — ie as a student not proceeding to a degree or diploma — may be permitted provided that in every case the Head of School offering the subject considers that the student will benefit from the enrolment and provided also that accommodation is available and that the enrolment does not prevent a place in that subject being available to a student proceeding to a degree or diploma.

(2) A student who is under exclusion from any subject in the University may not enrol as a miscellaneous student in that subject.

(3) A student who is under exclusion from any course in the University may not enrol in any subject which forms a compulsory component of the course from which the student is excluded.

(4) A student who is subsequently admitted to a course of the University for which any subjects completed as a miscellaneous student form a part may receive standing for those subjects.

(5) There are quota restrictions on the number of students allowed to enrol as miscellaneous, irrespective of whether they have approval from the Head of School. Applicants with written Head of School approval may be permitted to enrol providing there are places available in the quotas.

(6) As a general rule the University does not permit miscellaneous students to enrol in first year undergraduate subjects. Enquiries concerning eligibility for enrolment may be made at the Student Enquiry Counter, the Chancellery (telephone 697 3095).

9. Final Dates for Completion of Enrolment

No enrolments for courses extending over the whole year or for Session 1 only will be accepted from students after the end of the second week of Session 1 (13 March 1987) except with the express approval of the Registrar and the Heads of the Schools concerned. No enrolments for courses in Session 2 only will be accepted after the end of the second week of Session 2 (7 August 1987) except with the express approval of the Registrar and the Heads of the Schools concerned.

10. Student Card — Conditions of Issue

All students enrolled in degree or diploma courses or as miscellaneous students are issued with a University of New South Wales Student Card. All students are issued with cards on their initial enrolment.

The number appearing on the card below the student's name is the student registration number used in the University's records. This number should be quoted in all correspondence.

(1) The card must be carried at the University and shown on request. It must be presented when borrowing from the University libraries, when using Library facilities and when applying for concessions.

(2) The card is not transferable.

(3) The student to whom the card has been issued must notify the Circulation Department of the Library of its loss or theft. Failure to do so may result in the cardholder being held responsible for items issued on the card after its loss or theft.

(4) The card is valid only for the period of enrolment as indicated on the receipt issued by the Cashier at enrolment each year.

(5) The cardholder accepts responsibility for all Library books issued on his/her card and agrees to return books by the due date.

(6) If the card is damaged or becomes otherwise unusable, it is the cardholder's responsibility to seek replacement.

(7) The card always remains the property of the University and must be returned to it when the holder leaves the University.

11. Payment of Fees

The fees and charges which are payable include those charges raised to finance the expenses incurred in operating activities such as the University Union, the Students' Union, the Sports Association, and the Physical Education and Recreation Centre. Penalty payments are also incurred if a student fails to complete procedures as required. Charges may also be payable, sometimes in the form of a deposit, for the hiring of kits of equipment in certain subjects. Accommodation charges, costs of subsistence on excursions, field work etc, and for hospital residence (medical students) are payable in appropriate circumstances.

12. Assisted Students

Scholarship holders and sponsored students who have not received an enrolment voucher or appropriate letter of authority from their sponsor at the time when they are enrolling should pay their own fees and a refund will be made when the enrolment voucher or letter of authority is subsequently lodged with the Cashier.

Those unable to pay their own fees in these circumstances can apply for an extension of time (see section **13.** below) in which to pay. Such an application must be made before the fees are due.

13. Extension of Time

Students who are unable to pay fees by the due date may apply for an extension of time, which may be granted in extenuating circumstances. Such applications must be made, in writing, before the due date and lodged at the Student Enquiry Counter, the Chancellery.

14. Failure to Pay Fees and Other Debts

Students who fail to pay prescribed fees or charges or are otherwise indebted to the University and who fail either to make a satisfactory settlement of indebtedness upon receipt of due notice or to receive a special exemption cease to be entitled to the use of University facilities. Such students are not permitted to enrol for a further session, to attend classes or examinations, or to be granted any official credentials. In the case of students enrolled for Session 1 only or for both Sessions 1 and 2 this disbarment applies if any portion of fees is outstanding after the end of the eighth week of Session 1 (24 April 1987). In the case of students enrolled for Session 2 only this disbarment applies if any portion of fees is outstanding after the end of the sixth week of Session 2 (11 September 1987).

In special cases the Registrar may grant exemption from the disqualification referred to in the preceding paragraph upon

receipt of a written statement setting out all relevant circumstances.

15. Fees

Fees and penalties quoted are current at the time of publication but may be amended by the University without notice.

Administration Charge $250

University Union Entrance Fee

Payable on first enrolment $43

Students enrolling for only one session must pay the full University Union entrance fee.

Student Activities Fees

All students (with the exceptions set out in section **17.** below) are required to pay the following fees if enrolling for a program involving two sessions. Those enrolling for only one session will pay the full University Union Entrance Fee, if applicable, and one-half of any other fees due.

Students who consider themselves eligible for life membership of the University Union, or the Sports Association, should make enquiries about the matter at the offices of those bodies.

Students often seek exemption from some or all of the student activities fees for reasons other than those set out in section **17.** below. It is stressed that the fees charged are a contribution by students towards services and amenities for the University community (both now and in the future) and exemption from them cannot be claimed because a student is unable or unwilling to make use of some of those services or amenities.

Student Activities Fees are adjusted annually by a system of indexation and those set out below have been approved for 1987.

University Union annual subscription $123

Sports Association annual subscription $30

Students' Union Annual Subscription

Students enrolling in full-time courses $37

Students enrolling in part-time courses or as miscellaneous students $30

Miscellaneous Fund annual fee $43

This fee is used to finance expenses generally of a capital nature relating to student activities and amenities. Funds are allocated for projects recommended by the Student Affairs Committee and approved by the University Council.

Special Examination Fees

Examinations conducted in special circumstances for each subject $20

Review of examination results for each subject $20

Other Charges

In addition to the fees outlined above and depending on the subject being taken, students may be required to make a payment for equipment; money so paid is, in general, refunded if the equipment is returned in satisfactory condition.

16. Penalties

(1) Failure to lodge enrolment form according to enrolment procedure $20

(2) Payment of fees after end of second week of session $20

(3) Payment of fees after end of fourth week of session $40

Penalties (1) and (2) or (1) and (3) may accumulate.

17. Exemptions — fees

Students often seek exemption from the fees for reasons other than those set out below. It is stressed that the fees charged are a contribution by students towards services and amenities for the University community (both now and in the future) and exemption from them cannot be claimed because a student is unable or unwilling to make use of some of those services or amenities.

(1) Life members of the University Union, the Sports Association, and Students' Union are exempt from the relevant fee or fees.

Students who consider themselves eligible for life membership of the University Union or the Sports Association should make enquiries about the matter at the offices of those bodies.

(2) Students enrolled in courses classified as *External* are exempt from all Student Activities Fees and the University Union Entrance Fee.

(3) Students enrolled in courses at the University College (Australian Defence Force Academy) are exempt from the Student Activities Fees and the University Union Entrance Fee in section **15.** above but shall pay such other fees and charges as the Council may from time to time determine.

(4) University Union fees and subscriptions may be waived by the Registrar for students enrolled in graduate courses in which the formal academic requirements are undertaken at a part of the University away from the Kensington campus.

(5) Students who while enrolled at and attending another university (or other tertiary institution as approved by the Vice-Chancellor) in a degree or diploma course are given approval to enrol at the University of New South Wales but only as miscellaneous students for subjects to be credited towards the degrees or diplomas for which they are enrolled elsewhere are exempt from all Student Activities Fees and the University Union Entrance Fee.

Institutions approved are: Australian Film and Television School, New South Wales Institute of Technology, Sydney College of Advanced Education and Sydney College of Chiropractic.

(6) Undergraduate students of a recognized university outside Australia who attend the University of New South Wales with the permission of the head of the appropriate school or department to take part as miscellaneous students in an academic program relevant to their regular studies and approved by the authorities of their own institution are exempt from all Student Activities Fees and the University Union Entrance Fee.

(7) Graduate students not in attendance at the University and who are enrolling in a project only other than for the first time, are exempt from all Student Activities Fees.

(8) Graduate students resubmitting a thesis or project only are exempt from all Student Activities Fees.

(9) All Student Activities Fees, for one or more sessions, may be waived by the Registrar for students who are given formal permission to pursue their studies at another institution for one or more sessions.

(10) Graduate students who have completed all the work for a qualification at the commencement of session, except for the submission of the relevant thesis or project report, may be exempted from the payment of Student Activities Fees by the Registrar on production of an appropriate statement signed by the relevant Supervisor or Head of School.

(11) Students enrolled in a session or sessions devoted entirely to training or experience away from the campus and its associated laboratories, the teaching hospitals, centres, institutes and field stations are exempt from all Student Activities Fees for that session or sessions.

(12) Students whose registration is cancelled or suspended by the University shall receive refunds of fees paid in accordance with the provisions of section **18.** (5) below except that a refund of one half of the fees shall be made if such cancellation or suspension takes place between the end of the fourth week of Session 1 and the end of the fourth week of Session 2.

18. Variations in Enrolment (including Withdrawal)

(1) Students wishing to vary an enrolment program must make application on the *Variation of Enrolment* form available from the appropriate Course Authority and the Student Enquiry Counter.

(2) Students withdrawing from courses (and see also information about withdrawal from subjects below) are required to notify the Registrar in writing or complete the withdrawal form available from the Student Enquiry Counter. In some cases such students will be entitled to fee refunds (see (5) below).

(3) Enrolment in additional subjects

Applications for enrolment in additional subjects must be submitted by:

13 March 1987 for Session 1 only and whole year subjects;
7 August 1987 for Session 2 only subjects.

(4) Withdrawal from subjects

Applications to withdraw from subjects may be submitted throughout the year but applications lodged after the following dates will result in students being regarded as having failed the subjects concerned, except in special circumstances:

(a) for one session subjects, the end of the seventh week of that session (16 April or 18 September).

(b) for whole year subjects, the end of the second week of Session 2 (7 August).

(5) Withdrawal from Course

First year students who enrol and subsequently discontinue without failure their whole course will be permitted to re-enrol the following year providing they do not enrol at another tertiary institution. They must confirm their intention to re-enrol by lodging an application with the Universities and Colleges Admissions Centre.

(6) Refunds – Student Activities Fees

Whether or not a student's withdrawal entails academic penalties (covered in item (4) above) there are rules governing Student Activities Fees refunds in the case of complete withdrawal from a course as follows:

(a) If notice of withdrawal from a course is received before the first day of Session 1, a refund of all Student Activities Fees paid will be made.

(b) If notice of withdrawal is received on or after the first day of Session 1, a partial refund of the University Union Entrance Fee will be made on the following basis: any person who has paid the entrance fee in any year and who withdraws from membership of the University Union after the commencement of Session 1 in the same year, or who does not renew membership in the immediately succeeding year may on written application to the Warden receive a refund of half the entrance fee paid.

(c) If the notice of withdrawal is given before the end of the fourth week of Session 1 (27 March 1987) a full refund of Student Activities Fees paid will be made; if notice is given before the end of the seventh week of Session 1 (16 April 1987) a refund of three-quarters of the Student Activities Fees paid will be made; if notice is given before the beginning of Session 2 (27 July 1987) a refund of one-half of the Student Activities Fees paid will be made; if notice is given before the end of the seventh week of Session 2 (18 September 1987) a refund of one-quarter of Student Activities Fees paid will be made; thereafter no refund will be made except that provided for in (d) below.

(d) If a student's enrolment in any year is for one session only and the student gives notice of withdrawal prior to the end of the fourth week of that session (27 March or 21 August 1987) a full refund of Student Activities Fees paid will be made; if notice is given before the end of the seventh week of that session (16 April or 18 September 1987) a refund of one-half of the Student Activities Fees paid will be made; thereafter no refund will be made.

(e) The refunds mentioned in (c) and (d) above may be granted by the Registrar to a student unable to notify the Registrar in writing by the times required provided evidence is supplied that the student has ceased attendance by those times.

(7) Acknowledgements

The Registrar will acknowledge each application for a variation in enrolment (including withdrawals from subjects) as follows:

(a) variations lodged before the Friday of the seventh week of each session (17 April or 18 September) will be incorporated in the *Confirmation of Enrolment Program* notice forwarded to students on 28 April or 29 September as appropriate.

(b) variations lodged after those dates will be acknowledged by letter.

(c) withdrawals from a course are acknowledged individually whenever they are lodged.

(8) It is emphasized that failure to attend for any assessment procedure, or to lodge any material stipulated as part of an assessment procedure, in any subject in which a student is enrolled will be regarded as failure in that assessment procedure unless written approval to withdraw from the subject without failure has been obtained from the Registrar.

19. Exemption – Membership

The Registrar is empowered to grant exemption from membership of any or all of the University Union, the Students' Union

and the Sports Association to students who have a genuine conscientious objection to such membership, subject to payment of the prescribed fees to the Miscellaneous Fund.

Leave of Absence

Leave of absence from an undergraduate course of study may be granted to students other than those in the first year of a course. Leave of absence has generally been restricted to one year but in special circumstances two years have been granted.

To apply for such leave of absence, a letter should be submitted to the Registrar immediately following the release of annual examination results and must include the student's full name, registration number, the course and stage in which enrolled in the previous year and, most important, the reason *why* leave is being sought. The letter advising the result of the application will provide details about how to re-enrol.

Higher degree and graduate diploma candidates may apply for suspension of enrolment under similar conditions.

Undergraduate Course Transfers

Students wishing to transfer from one course to another must complete and submit an application form, obtainable from the Student Enquiry Counter, the Chancellery, by Friday 9 January 1987.

Students whose applications to transfer are successful, and who are transferring from one school to another are required to comply with the enrolment procedure laid down for new students with advanced standing. *Students transferring* from one course to another *within the same school* are required to attend the appropriate enrolment session for the course to which they have approval to transfer.

Students must present the approval to transfer to the enrolling officer, and those who have not received advice regarding their application to transfer before the date on which they are required to enrol should check with the office of the Admissions Section.

Students should also advise the enrolling officer in the school in which they were enrolled in 1986 of their intention to transfer.

Admission with Advanced Standing

Any persons who make application to register as a candidate for any degree or other award granted by the University may be admitted to the course of study leading to such degree or award with such standing on the basis of previous attainments as may be determined by the Professorial Board provided that:

1. the Board shall not grant such standing under these rules as is inconsistent with the rules governing progression to such degree or award as are operative at the time the application is determined;

2. where students transfer from another university such students shall not in general be granted standing in this University which is superior to what they have in the University from which they transfer;

3. the standing granted by the Board in the case of any application based on any degree/s or other awards already held by the applicants, shall not be such as will permit them to qualify for the degree or award for which they seek to register without completing the courses of instruction and passing the examinations in at least those subjects comprising the later half of the course, save that where such a program of studies would involve them repeating courses of instruction in which the Board deems them to have already qualified, the Board may prescribe an alternative program of studies in lieu thereof;

4. the standing granted by the Board in the case of any application based on partial completion of the requirements for any degree or other award of another institution shall not be such as will permit the applicants to qualify for the degree or award for which they seek to register by satisfactory completion of a program of study deemed by the Board to be less than that required of students in full-time attendance in the final year of the course in which the applicants seek to register;

5. the standing granted by the Board in the case of any application based on the partial completion of the requirements for any degree or other award of the University may be such as to give full credit in the course to which the applicants seek to transfer for work done in the course from which they transfer.

Where the identity between the requirements for any award of the University already held and that of any other award of the University is such that the requirements outstanding for the second award are less than half the requirements of that award, students who merely complete such outstanding requirements shall not thereby be entitled to receive the second award but shall be entitled to receive a statement over the hand of the Registrar in appropriate terms.

Resumption of Courses

Students who have had a leave of absence for twelve months and wish to resume their course should follow the instructions about re-enrolling given in the letter granting leave of absence. If these instructions are not fully understood or have been lost, students should contact the office of the Admissions Section before November in the year preceding the one in which they wish to resume their course.

If students have not obtained leave of absence from their course and have not been enrolled in the course over the past twelve months or more, they should apply for admission to the course through the Universities and Colleges Admissions Centre before 1 October in the year preceding that in which they wish to resume studies.

Examinations

Examinations are held in June/July and in November/December.

Timetables

Provisional timetables indicating the dates and times of examinations are posted on the University noticeboards in May and

October. Students must advise the Examinations Section (the Chancellery) of any clash in examinations.

Final timetables indicating the dates, times, locations, and authorized materials are available for students two weeks before the end of each session.

Misreading of the timetable is not an acceptable excuse for failure to attend any examination.

Assessment of Course Progress

In the assessment of a student's progress in a course, consideration may be given to work in laboratory and class exercises and to any term or other tests given throughout the year as well as to the results of written examinations.

Examination Results

Assessment result advices include the final composite marks students achieve in subjects taken that session.

Grading of Passes

Passes are graded as follows:

High Distinction	an outstanding performance
Distinction	a superior performance
Credit	a good performance
Pass	an acceptable level of performance
Satisfactory	satisfactory completion of a subject for which graded passes are not available

Pass Conceded

A pass conceded may be granted provided that the overall performance is considered to warrant such a concession. A pass conceded in a subject will allow progression to another subject for which the former subject is a prerequisite.

Pass Terminating

A pass terminating may be granted provided that the overall performance is considered to warrant such a concession. A pass terminating does not allow progression to another subject for which the former subject is a prerequisite.

Availability of Results

Final examination results will be posted to a student's term address, or vacation address if requested. Forms requesting that results be posted to a vacation address and change of address forms are obtainable at the Student Enquiry Counter, the Chancellery. Forms can be accepted up to Friday 3 July for Session 1 results and Friday 4 December for Session 2 and whole year results. Results are also posted on School noticeboards and in the University Library. Results on noticeboards are listed *by Student Registration Number.*

No examination results are given by telephone.

Review of Results

A student may make application to the Registrar for the review of a result. The application form, accompanied by an appropriate fee, must be submitted not later than fifteen working days after the date of issue of the *Notification of Result of Assessment* form.

In reviewing a result, the subject authorities shall ensure that all components of the assessment have been assessed and a mark assigned.

A review of a result is not a detailed reassessment of a student's standard of knowledge and understanding of, and skills in, the subject. It is rather a search for arithmetic error in arriving at the composite mark and for gross and obvious error in assignment of marks in components of the final composite mark.

When a change in grade is recommended, the application fee will be refunded by the Registrar.

Special Consideration

Students who believe that their performance in a subject, either during session or in an examination, has been adversely affected by sickness or any other reason should inform the Registrar and ask for special consideration in the determination of their standing.

Such requests should be made as soon as practicable after the occurrence and in any event no more than seven days after the final examination in a subject.

When submitting a request for special consideration students should provide all possible supporting evidence (eg medical certificates) together with their registration number and enrolment details.

Physical Disabilities

Students suffering from a physical disability which puts them at a disadvantage in written examinations should advise the Officer-in-Charge Examinations Section (Ground Floor, the Chancellery) immediately their disability is known. If necessary, special arrangements will be made to meet the student's requirements.

Students who are permanently disabled and need to make special arrangements for their examinations, should contact the Examinations Section as soon as the final timetable becomes available.

Use of Computers and Electronic Calculators

The use of computers or electronic calculators may be permitted in examinations conducted within the University. Computers and electronic calculators which are authorized by the University for this purpose must be *hand-held, internally powered, and silent.* Computers are distinguished from electronic calculators for this purpose by the existence of a full alphabetic keyboard on them. Computers are not permitted in examinations for which an electronic calculator has been specified. When an electronic calculator is permitted in an examination, any programmable memory on it must be cleared prior to entering an examination room.

The University does not provide computers or electronic calculators of the kind described in this rule for use in examinations although some schools may make them available in special circumstances.

Examinations Held Away from the Campus

Except in the case of students enrolled on external courses, examinations will not be permitted away from the campus unless the candidate is engaged on *compulsory industrial training.* Candidates must advise the Officer-in-charge, Examinations Section, immediately the details of the industrial training are known. Special forms for this purpose are available at the Student Enquiry Counter in the north wing of the Chancellery.

Arrival at Examinations

Examination Rooms will be open to students twenty-five minutes before the commencement of the examination. Candidates are required to be in their places at least fifteen minutes before the commencement to hear announcements.

Reading the Examination Paper

The examination paper will be available for reading ten minutes before the instruction is given to commence writing.

Use of Linguistic Dictionaries

The answers in all examinations and in all work submitted must be in English unless otherwise directed. Students may apply for permission to use standard linguistic dictionaries in the presentation of written work for assessment. Such applications should be made in writing to the Officer-in-charge, Examinations Section not later than 14 days prior to the need to use the linguistic dictionary.

Academic Misconduct

Students are reminded that the University regards academic misconduct as a very serious matter. Students found guilty of academic misconduct are usually excluded from the University for two years. Because of the circumstances in individual cases the period of exclusion can range from one session to permanent exclusion from the University.

The following are some of the actions which have resulted in students being found guilty of academic misconduct in recent years:

1. taking unauthorized materials into an examination;

2. submitting work for assessment knowing it to be the work of another person;

3. improperly obtaining prior knowledge of an examination paper and using that knowledge in the examination.

4. failing to acknowledge the source of material in an assignment.

Conduct of Examinations

Examinations are conducted in accordance with the following rules and procedure:

1. Candidates are required to obey any instruction given by an examination supervisor for the proper conduct of the examination.

2. Candidates are required to be in their places in the examination room not less than fifteen minutes before the time for commencement.

3. No bag, writing paper, blotting paper, manuscript or book, other than specified material, is to be brought into the examination room.

4. Candidates shall not be admitted to an examination after thirty minutes from the time of commencement of the examination.

5. Candidates shall not be permitted to leave the examination room before the expiry of thirty minutes from the time the examination commences.

6. Candidates shall not be re-admitted to the examination room after they have left it unless, during the full period of their absence, they have been under approved supervision.

7. Candidates shall not by any improper means obtain, or endeavour to obtain, assistance in their work, give, or endeavour to give, assistance to any other candidate, or commit any breach of good order.

8. All answers must be in English unless otherwise stated. Foreign students who have the written approval of the Registrar may use standard linguistic dictionaries.

9. Smoking is not permitted during the course of examinations.

10. A candidate who commits any infringement of the rules governing examinations is liable to disqualification at the particular examination, to immediate expulsion from the examination room and to such further penalty as may be determined in accordance with the By-laws.

Writing in Examinations

Candidates are permitted to take pens, pencils and erasers into the examination room but are advised that all answers must be written in ink. Except where expressly required, pencils may be used only for drawing, sketching or graphical work.

Acknowledgement of Sources

Students are expected to acknowledge the source of ideas and expressions used in submitted work. To provide adequate documentation is not only an indication of academic honesty but also a courtesy enabling the marker to consult sources with ease. Failure to do so may constitute plagiarism, which is subject to a charge of academic misconduct.

Further Assessment

In special circumstances further assessment including assessment or further assessment on medical or compassionate grounds may be granted.

Further assessment may be given by the subject authority at his or her discretion at any time prior to the meeting of the relevant faculty assessment committee (normally the fourth week of the Midyear Recess and the second week of December). Further assessment may also be awarded at the faculty assessment committee and students affected may need to be free to undertake that further assessment in the last week in the Midyear Recess and in the period up to the end of the second week in January; students should consult their subject authority for details of further assessment immediately their results are known.

Restriction upon Students Re-enrolling

The University Council has adopted the following rules governing re-enrolment with the object of requiring students with a record of failure to show cause why they should be allowed to re-enrol and retain valuable class places.

First Year Rule

1. Students enrolled in the first year of any undergraduate course of study in the University shall be required to show cause why they should be allowed to continue the course if they do not pass the minimum number of subjects, units or credits prescribed for this purpose by the relevant faculty or board of studies.

The prescribed minimum for each undergraduate course may be found in **Schedule A** below; the schedule may be varied from time to time by the Professorial Board.

The first year rule does not apply to students who discontinue without failure all Session 2 and whole-year subjects.

Repeated Failure Rule

2. Students shall be required to show cause why they should be allowed to repeat a subject which they have failed more than once. Where the subject is prescribed as part of the course they shall also be required to show cause why they should be allowed to continue that course.

General Rule

3. (1) Students shall be required to show cause why they should be allowed to repeat a subject they have failed if the assessment committee of the faculty or board of studies so decides on the basis of previous failures in that subject or in a related subject. Where the subject is prescribed as part of the course they shall also be required to show cause why they should be allowed to continue that course.

(2) Students shall be required to show cause why they should be allowed to continue their course if the assessment committee of the faculty or board of studies so decides on the basis of their academic record.

The Session-Unit System

4. (1) Students who infringe the provisions of Rules **1.** or **2.** at the end of Session 1 of any year will be allowed to repeat the subject(s) (if offered) and/or continue the course in Session 2 of that year, subject to the rules of progression in the course.

(2) Such students will be required to show cause at the end of the year, except that students who infringe Rule **2.** at the end of Session 1, and repeat the subjects in question in Session 2, and pass them, will not be required to show cause on account of any such subjects.

Exemption from Rules by Faculties

5. (1) A faculty or board of studies assessment committee may, in special circumstances, exempt students from some or all of the provisions of Rules **1.** and **2.**

(2) Such students will not be required to show cause under such provisions and will be notified accordingly by the Registrar.

Showing Cause

6. (1) Students wishing to show cause must apply for special permission to re-enrol. Application should be made on the form available from the Registrar and must be lodged with the Registrar by the dates published annually by the Registrar. A late application may be accepted at the discretion of the University.

(2) Each application shall be considered by the Admissions and Re-enrolment Committee of the relevant faculty or board of studies which shall determine whether the cause shown is adequate to justify the granting of permission to re-enrol.

Appeal

7. (1) Students who are excluded by the Admissions and Re-enrolment Committee from a course and/or subject under the provisions of the Rules will have their applications to re-enrol reconsidered automatically by the Re-enrolment Committee of the Professorial Board.

(2) Students whose exclusion is upheld by the Re-enrolment Committee may appeal to an Appeal Committee constituted by Council for this purpose with the following membership:

A Pro-Vice-Chancellor, nominated by the Vice-Chancellor who shall be Chairman.

The Chairman of the Professorial Board, or if its Chairman is unable to serve, a member of the Professorial Board, nominated by the Chairman of the Professorial Board, or when the Chairman of the Professorial Board is unable to make a nomination, nominated by the Vice-Chairman.

One of the category of members of the Council elected by the graduates of the University, nominated by the Vice-Chancellor.

The decision of the Committee shall be final.

(3) The notification to students of a decision which has been upheld by the Re-enrolment Committee of the Professorial Board to excude them from re-enrolling in a course and/or subject shall indicate that they may appeal against that decision to the Appeal Committee. The appeal must be lodged with the Registrar within fourteen days of the date of notification of exclusion; in special circumstances a late appeal may be accepted at the discretion of the chairman of the Appeal Committee. In lodging such an appeal with the Registrar students should provide a complete statement of all grounds on which the appeal is based.

(4) The Appeal Committee shall determine appeals after consideration of each appellant's academic record, application for special permission to re-enrol, and stated grounds of appeal. In particular circumstances, the Appeal Committee may require students to appear in person.

Exclusion

8. (1) Students who are required to show cause under the provisions of Rules **1.** or **3.** and either do not attempt to show cause or do not receive special permission to re-enrol from the Admissions and Re-enrolment Committee (or the Re-enrolment Committee on appeal) shall be excluded, for a period not in excess of two years, from re-enrolling in the subjects and courses on account of which they were required to show cause. Where the subjects failed are prescribed as part of any other course (or courses) they shall not be allowed to enrol in any such course.

(2) Students required to show cause under the provisions of Rule **2.** who either do not attempt to show cause or do not receive special permission to re-enrol from the Admissions and Re-enrolment Committee (or the Re-enrolment Committee on appeal) shall be excluded, for a period not in excess of two years, from re-enrolling in any subject they have failed twice. Where the subjects failed are prescribed as part of a course they shall also be excluded from that course. Where the subjects failed are prescribed as part of any other course (or courses) they shall not be allowed to enrol in any such course.

Re-admission after Exclusion

9. (1) Excluded students may apply for re-admission after the period of exclusion has expired.

(2) (a) Applications for re-admission to a course should be made to the Universities and Colleges Admissions Centre before the closing date for normal applications in the year prior to that in which re-admission is sought. Such applications will be considered by the Admissions and Re-enrolment Committee of the relevant faculty or board of studies.

(b) Applications for re-admission to a subject should be made to the Registrar before 30 November in the year prior to that in

which re-admission is sought. Such applications will be considered by the relevant subject authority.

(3) Applications should include evidence that the circumstances which were deemed to operate against satisfactory performance at the time of exclusion are no longer operative or are reduced in intensity and/or evidence of action taken (including enrolment in course/s) to improve capacity to resume studies.

(4) Students whose applications for re-admission to a course or subject are unsuccessful (see **9.** (2) (a), (b) respectively) will be invited to appeal to the Re-Enrolment Committee of the Professorial Board. The decision of the Re-Enrolment Committee will be final.

10. Students who fail a subject at the examinations in any year or session and re-enrol in the same course in the following year or session must include in their programs of studies for that year or session the subject which they failed. This requirement will not be applicable if the subject is not offered the following year or session, is not a compulsory component of a particular course, or if there is some other cause which is acceptable to the Professorial Board, for not immediately repeating the failed subject.

Restrictions and Definitions

11. (1) These rules do not apply to students enrolled in programs leading to a higher degree or graduate diploma.

(2) A subject is defined as a unit of instruction identified by a distinctive subject number.

Schedule A

(See First Year Rule **1.** above)

Where the minimum requirement is half the program, this is defined as half the sum of the unit values of all the subjects in a student's program.

Faculty/Board of Studies	Minimum Requirement	Course	Unit Values (UV)
Applied Science	Half the program	3000-3220	One-session subjects: UV 1 Two-session subjects: UV 2
Architecture	Half the program	3275, 3330	Elective subjects: UV 0 All other subjects: appropriate UV corresponding to credit points*
		3360, 3380	Elective subjects: UV 0 All other subjects: UV equal to the allocated hours*
Arts	18 Level I credit points*	3400-3420	
Biological Sciences	4 units	3431	Science subjects: appropriate UV* Arts subjects: 6 credit points = UV 1 12 credit points = UV 2
Commerce	Three subjects	3490-3595 FT in both sessions	
	Two subjects	3490-3595 PT in either session	
Engineering	Half the program including Physics I or Mathematics I	3610-3612, 3660-3662, 3680-3682, 3700-3702	5.061: UV 0 One-session subjects: UV 1 Two-session subjects: UV 2
	Half the program including Statics or Mathematics I	3620, 3730	All subjects: UV equal to the allocated hours*
	Half the program including Physics I or Mathematics I	3640, 3720-3725	One-session subjects: UV 1 Two-session subjects: UV 2
	Half the program	3740, 3760	One-session subjects: UV 1 Two-session subjects: UV 2
Law	Half the program	4710-4790	One-session subjects: UV 1 90.741: UV 0 All other two-session subjects: UV 2
Medicine	Half the program	3800	80.010: UV 3 81.001: UV 3 81.002: UV 6 70.001: UV 4 One General Studies elective: UV 1
Professional Studies	Half the program	4030, 4040	All subjects: UV 1
		4070-4080	All subjects: appropriate UV* One General Studies elective: UV 1
Science	Half the program	3950-3951	All subjects: appropriate UV* One General Studies elective: UV 1
Science and Mathematics	2 units	3970	All subjects: appropriate UV* One General Studies elective: UV 1
University College (Australian Defence Force Academy)	Half the program	BA, BSc	All subjects: UV 1
		BE	All subjects: appropriate weighted mark*

Admission to Degree or Diploma

Students whose current program will enable them to complete all requirements for the degree or diploma, including industrial training where necessary, should lodge with the Registrar the form *Application for Admission to Degree/Diploma* and return it to the Registrar by the second Monday in May for the October ceremonies, and the second Friday in October for all other ceremonies. The forms are available from the Student Enquiry Counter in the north wing of the Chancellery.

Students who have indicated on their enrolment form that they are potential graduands are forwarded an application form with their *Confirmation of Enrolment Program* notice in September (or, in the case of students who expect to satisfy requirements at the end of Session 1, with the form issued in April). Students who do not complete an application form will not graduate; students who do not return their application form by the due date will graduate at a later series of ceremonies.

Students enrolled in courses **3400, 3910, 3970, 8080, 8220, and 8240** who have completed an application form to graduate at the pass level and who then decide to proceed to an honours year should advise the Registrar, in writing before September for those completing requirements at the end of Session 1, or before March for those completing requirements at the end of Session 2.

A list of graduands in Medicine who have applied for their degree is published in *The Sydney Morning Herald* in January.

A list of graduands other than Medicine who have applied for their degree/diploma and who expect to graduate in April/May the following year is published in *The Sydney Morning Herald* on the first Wednesday in March.

A list of graduands other than Medicine who have applied for their degree/diploma and who expect to graduate in October is published in *The Sydney Morning Herald* on the first Wednesday in September.

Students who are potential graduands and who wish to notify the Registrar of a change of address should submit an additional form *Final Year Students' Graduation: Change of Address.*

If graduands are indebted to the University their names will not appear in the list of graduands published in the newspaper, and they will not be permitted to graduate until the debt has been cleared.

Attendance at Classes

Students are expected to be regular and punctual in attendance at all classes in the subjects in which they are enrolled. All applications for exemption from attendance at classes of any kind must be made in writing to the Registrar.

In the case of illness or of absence for some other unavoidable cause students may be excused by the Registrar for non-attendance at classes for a period of not more than one month or, on the recommendation of the Dean of the appropriate faculty, for a longer period.

Absence from Classes

Explanations of absences from classes, or requests for permission to be absent from forthcoming classes, should be addressed to the Registrar and, where applicable, should be accompanied by a medical certificate. If examinations or other forms of assessment have been missed, this should be stated in the application.

If students attend less than eighty per cent of their possible classes they may be refused final assessment.

Student Records

Confirmation of Enrolment Program notices are sent to all students in April and September. It is not necessary to return these forms unless any of the information recorded is incorrect. If amendments need to be made, students should contact the appropriate course office.

Release of Information to Third Parties

The University treats results of assessment and information it receives from a student as confidential and will not reveal such information to third parties without the permission of the student except at the discretion of senior officers in circumstances considered of benefit to the student and when it is either impossible or impracticable to gain the student's prior permission. This happens rarely. This policy is considered so important that it often involves officers of the University in very difficult situations, for example, when they must refuse to reveal the address of a student to parents or other relatives.

In spite of the policy, all students should be aware that students' addresses are eagerly sought by various commercial agents and that subterfuges of various kinds can be used to obtain them. From time to time, for example, people claiming to be from the University telephone students or their families and ask for information (usually another student's address) which is often given, unsuspectingly. There is evidence that this is a technique used by some commercial agents.

It would be generally helpful if students (and their families and friends) are cautious in revealing information, making it a practice to ask the name, position, and telephone extension of any caller claiming to be from the University and, if suspicious, returning the call to the extension given.

Change of Address

The Student Records and Scholarships Office of the Department of the Registrar should be notified as soon as possible of any change of address. Failure to do this could lead to important correspondence (including results of assessment) going astray. The University cannot accept responsibility if official communications fail to reach students who have not given notice of their change of address. *Change of Address Advice* forms are available at Faculty and School offices and from the Student Enquiry Counter in the north wing of the Chancellery.

All communications from the University will be sent to the Session or Term address except when arrangements are made otherwise in the case of results of assessment (see **Examinations: Availability of Results**, earlier in this section). *Change of Address Advice* forms will be accepted up to Friday 4 December, except for final-year students wishing to change their *Application for Admission for Degree/Diploma* form. Changes to this form will be accepted up to a date four weeks before the student's graduation ceremony.

Ownership of Students' Work

The University reserves the right to retain at its own discretion the original or one copy of any drawings, models, designs, plans and specifications, essays, theses or other work executed by students as part of their courses, or submitted for any award or competition conducted by the University.

Notices

Official University notices are displayed on the noticeboards and students are expected to be acquainted with the notices which concern them. These boards are in the Biological Sciences Building, the Mathews Building, the Chancellery (lower ground floor), Central Lecture Block, Dalton Building (Chemistry), Main Building (Physics and Mining) and in the Western Grounds Area.

Parking within the University Grounds

A limited amount of parking is available on campus. Copies of the University's parking rules may be obtained on application to Room 240, the Chancellery.

Academic Dress

Information about the University's academic dress requirements may be obtained from the Ceremonials Section, Room LG2, the Chancellery (phone extension 3112).

Further Information

Lost Property

All enquiries concerning lost property should be made to the Supertintendent (Patrol and Cleaning Services) on extesion 3460 or to the Lost Property Office at the Union.

The Calendar

Please consult the Calendar for a more detailed account of the information contained in this section.

Foreword

The Faculty of Applied Science is where science-based and engineering-based disciplines that are directly concerned with some aspect of Australia's natural resources have been established in a single Faculty. As a consequence there are many specialized options available to students that are based upon a wide range of inter-disciplinary and multi-disciplinary course options.

The undergraduate courses in the Faculty are: **Applied Geology** (including specialization in Mineral Resources, Basin Analysis, Engineering Geology and Geophysics); **Ceramic Engineering; Chemical Engineering** (including Fuel 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; Mineral Engineering; Mining Geology; Petroleum Engineering; Textile Technology** (including Textile Chemistry, Textile Engineering, Textile Manufacture and Textile Physics); **Wool and Pastoral Sciences.** Biotechnology offers an honours degree course in the Faculty of Science.

In most Schools there is also a variety of other options available. Students should discuss their programmes with appropriate staff to ensure that their chosen course of study is appropriate to their aims and aspirations.

There is a wide range of research programs in the Faculty; many of the staff have achieved international recognition for their work, and there is much that you, as students, can learn from them. It is essential, however, that you participate fully in your study program from the first day of your 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 Faculty is dynamic with changing activities and programs to meet the rapid technological developments in applied science. The staff are enthusiastic and I hope that you will share their enthusiasm. The importance of Applied Science to the University — and to the wider community outside — is fully recognized and is especially referred to in the University Act of Incorporation.

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

Faculty Information

Some People Who Can Help You

If you require advice and information of a general nature contact:

Mr R. Starr, Senior Administrative Officer, Faculty of Applied Science. Room 103, Sir Robert Webster Building. Tel. (02) 697 4469.

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

Applied Geology Mr G. Baldwin, Senior Administrative Officer.
Room 1013, Applied Science Building. Tel. 697 4262

Chemical Engineering and Industrial Chemistry Dr D. C. Dixon.
Room 314, Applied Science Building. Tel. 697 4319.

Food Science and Technology Mr R. Greenwood, Administrative Officer.
Room 411, Applied Science Building. Tel. 697 4364.

Geography Mr P. Dunkley, Administrative Assistant.
Room G10, Geography and Surveying. Tel. 697 4386.

Materials Science and Engineering Mrs E. Carlysle-Sainty, Clerk.
Room 110B, Materials Science and Engineering Building. Tel. 697 4436.

Mineral Engineering Associate Professor R. Robins.
Room 213, Materials Science and Engineering Building. Tel. 697 4429.

Mining Engineering Mr R. Rolls, Administrative Assistant.
Room 51B, Main Building. Tel. 697 4516.

Textile Technology Mr R. Starr, Senior Administrative Officer.
Room 103, Sir Robert Webster Building. Tel. 697 4469.

Wool Science Mr J. Lawrence, Administrative Officer.
Room 102, Wool and Pastoral Sciences Building. Tel. 697 4492.

Faculty of Applied Science Enrolment Procedures

All students re-enrolling in 1987 should obtain a copy of the free booklet *Enrolment Procedures 1987* available from School Offices and the Admissions Office. This booklet 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.

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 Food Science and Technology, Health Administration and Wool and Pastoral Sciences. 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 library and in specific subject material can be arranged.

Computerized literature searches and interlibrary loans are also available.

Acting Biomedical Librarian Betty McEwin

The Physical Sciences Library

This library, situated on Levels 6 and 7 of the Library tower, caters for the information needs of staff, graduate and undergraduate students in the pure and applied sciences, engineering and architecture. Details of the books, series and microfilms in the Physical Sciences Library are included in the microfiche monograph and serial catalogues and the items themselves are identified by the prefix 'P'. Serials with the prefix 'PJ' are not available for loan, but self-service photocopying facilities are located on Level 7. This library provides reference, reader assistance and reader education services and also, where appropriate, inter-library loan and literature-searching services. Trained staff are available on Level 7 to assist readers with their enquiries.

Physical Sciences Librarian Marian Bate

The Bachelor of Social Science Degree Course (3420)

The Bachelor of Social Science (BSocSc) is a degree course of special interest to students wishing to pursue careers in research, teaching, social planning and social administration. It enables students to gain a broad view of social issues, and introduces them to a diversity of social data. The program combines depth and breadth by requiring students to undertake a range of studies and to complete compulsory courses in the theories and methods of the various social sciences.

Although administered by the Faculty of Arts, the BSocSc degree course allows for in-depth study in two major disciplines drawn from various faculties. These disciplines are economic History, Economics, Industrial Relations, Geography, History, History and Philosophy of Science, Mathematics, Philosophy, Political Science, Psychology, Sociology and Statistics.

It may be possible for a limited number of students who have completed a year of study in a faculty other than Arts to transfer into the second year state of the course if their performance in at least two of the above disciplines is of a sufficiently high standard (Credit grade or better).

For futher enquiries, contact the Arts Faculty Office, Room G1, Morven Brown Building. Tel. 697 2288.

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

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

1. A candidate for the award of the degree of Bachelor of Science or Bachelor of Engineering shall:

(1) comply with the requirements for admission;

(2) follow the prescribed course of study in the appropriate School, and satisfy the examiners in the necessary subjects;

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

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

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

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

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

The courses leading to the award of the degree of Bachelor of Science (Technology) or Bachelor of Science (Engineering) in the

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

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

(1) comply with the requirements for admission;

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

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

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

3. The degrees 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 Studies Program

Almost all undergraduates in faculties other than Arts and Law are required to complete a General Studies program. The only course in the Faculty of Applied Science which does not have this requirement is the Bachelor of Science course in Economic Geography.

For further details, consult **General Information** earlier in this handbook.

Undergraduate Study

Course Outlines

The Faculty of Applied Science consists of the Schools of Biological Technologies, 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) or Bachelor of Science (Engineering).

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, Metallurgy, Textile Technology 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, Mineral 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.

Honours: Candidates for a degree at Honours level are required to undertake special reading and other assignments as directed by the Head of the School concerned. In considering the award of Honours special attention is paid to the performance of a candidate in the final research project, for which a thesis describing a theoretical or experimental study is required. 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 practial 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 School of Food Science and Technology; in Industrial Chemistry by the School of Chemical Engineering and Industrial Chemistry; and in Metallurgy and Ceramic Engineering 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.

School of Biological Technologies

Head of School
Professor R. A. Edwards
Administrative Officer
Mr R. J. Greenwood

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 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 full-time or two years part-time is designed for graduates in science or agriculture wishing to familiarize themselves with the principles of food technology.

General Studies Electives

For details of changes in the General Studies requirements refer to the table earlier in this chapter.

3060
Food 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 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
1.001 1.021	Physics 1 *or* Introductory Physics 1	6	6
2.121	Chemistry 1A	6	0
2.131	Chemistry 1B	0	6
10.001 10.011 10.021B 10.021C	Mathematics 1 *or* Higher Mathematics 1 *or* General Mathematics 1B *and* General Mathematics 1C	6	6
17.031	Biology A	6	0
17.041	Biology B	0	6
		24	24

Year 2

		Hours per week S1	S2
2.102A	Physical Chemistry	0	6
2.102B	Organic Chemistry	2	4
2.102D	Chemical and Spectroscopic Analysis	0	6
38.122	Man and Food	1	0
38.421	Food Engineering 1	0	3
38.521	Introductory Nutrition	3	0
41.101	Introductory Biochemistry	12	0
44.101	Introductory Microbiology	6	0
44.121	Microbiology 1	0	6
	General Studies Elective	4	0
		28	25

Year 3

2.043L	Chemistry and Enzymology of Foods	6	6
10.301	Statistics SA	2	2
38.131	Principles of Food Preservation	4	0
38.132	Plant Food Science	3	0
38.133	Animal Food Science	0	2
38.134	Food Science Laboratory	6	6
38.135	Food Quality Assessment	0	3
38.331	Food Microbiology 1	3	0
38.432	Food Engineering 2	3	0
	General Studies Elective	0	4
		27	23

Year 4

38.140	Food Technology Project	8	8
38.141	Food Regulation and Control	3	0
38.146	Inspections	0	3
38.444	Computer Applications in Food Technology	2	0
	General Studies Elective	2	2
		15	13

Plus *three or more* of the following electives to a total of not less than 9 hours per week.

2.003B	Organic Chemistry	0	6
18.121	Production Management	3	3
18.551	Operations Research	3	3
28.012	Marketing Systems	4	0
28.052	Marketing Research	0	4
38.142	Oenology	6	0
38.143	Cereal Technology	6	0
38.144	Treatment and Utilization of Food Processing Wastes	0	3
38.145	Marine Products Technology	2	0
38.149	Postharvest Technology of Fruit and Vegetables	6	0
38.171	Special Topics in Meat Science	2	0
38.341	Food Microbiology 2	0	6
38.344	Yeast Technology	3	0
38.443	Food Engineering 3	6	0
38.541	Advanced Nutrition	0	3
38.544	Nutritional Evaluation of Foods	0	6
42.102A	Biotechnology A	6	0
42.102B	Biotechnology B	0	6

or such other electives, to a total of not less than 9 hours per week, as approved by the Head of School.

During Years 2, 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 Technology — Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

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
1.001	Physics 1 *or*		
1.021	Introductory Physics 1	6	6
2.121	Chemistry 1A	6	0
2.131	Chemistry IB	0	6
10.001	Mathematics 1 *or*	6	6
10.011	Higher Mathematics 1† *or*		
10.021B	General Mathematics 1B *and*		
10.021C	General Mathematics 1C		
17.031	Biology A	6	0
17.041	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

2.102B	Organic Chemistry	0	6
2.102D	Chemical and Spectroscopic Analysis	0	6
41.101	Introductory Biochemistry	12	0
		12	12

Stage 4		Hours per week S1	S2
2.102A	Physical Chemistry	0	6
38.122	Man and Food	1	0
38.421	Food Engineering 1	0	3
38.521	Introductory Nutrition	3	0
44.101	Introductory Microbiology	6	0
44.121	Microbiology 1	0	6
	General Studies Elective	4	0
		14	15

Stage 5			
2.043L	Chemistry and Enzymology of Foods	6	6
10.301	Statistics SA	2	2
38.135	Food Quality Assessment	0	3
38.432	Food Engineering 2	3	0
	General Studies Elective	2	2
		13½	13½

Stage 6			
38.131	Principles of Food Preservation	4	0
38.132	Plant Food Science	3	0
38.133	Animal Food Science	0	2
38.134	Food Science Laboratory	6	6
38.331	Food Microbiology 1	3	0
		16	8

Biological process engineering is the extension of chemical engineering principles to systems involving biological materials. Typical areas of interest are: the manufacture of antibiotics; the fermentation industries; bacterial mineral extraction; and the production of industrially useful materials by the growth and utilization of micro-organisms.

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

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

For the award of Honours in both the Chemical Engineering and Industrial Chemistry degree courses, students need to have distinguished themselves in the formal work, in other assignments as directed by the Head of the School, and in the final year project, for which a thesis is required.

It is compulsory that before completion of the course students in the full-time course in Chemical Engineering must obtain a minimum of twelve weeks' professionally oriented, or industrial experience. Students in the part-time courses in Chemical Engineering should complete three years of industrial training concurrently with their University work.

It is recommended that before graduation students in the full-time courses in Industrial Chemistry obtain a minimum of eight 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.

School of Chemical Engineering and Industrial Chemistry

Head of School
Professor C. J. D. Fell

The former Schools of Chemical Engineering and Chemical Technology were amalgamated in January 1980 to form the combined School of Chemical Engineering and Industrial Chemistry. The new school offers the courses previously taught by the former two schools, ie a course in Chemical Engineering and a course in Industrial Chemistry. The combined school contains the Departments of Chemical Engineering and Industrial Chemistry which service the two degree courses, and the Departments of Biological Process Engineering, Fuel Technology and Polymer Science which offer professional electives in these degree courses.

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.

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.

Year 1		Hours per week S1	S2
1.001	Physics 1	6	6
2.121	Chemistry 1A *and*		
2.131	Chemistry 1B *or*	6	6
2.141	Chemistry 1M	6	6
5.001	Engineering M	0	6
5.030	Engineering C (includes 48.001 Introduction to Chemical Industry)	6	0
10.001	Mathematics 1 *or*		
10.011	Higher Mathematics 1	6	6
		24	24

Year 2

		Hours per week S1	S2
2.102A	Physical Chemistry	6	0
2.102B	Organic Chemistry	2	4
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.021	Chemical Engineering 1A	4	1
48.022	Chemical Engineering 1B	1	4
48.311	Fuel Engineering 1*	2	2
48.121	Corrosion in Chemical Industry	0	2
48.122	Instrumental Analysis	3	3
	Two General Studies Electives	4	4
		26	24

*In certain cases this subject may be replaced by another elective with approval of the Head of School.

Year 3

6.854	Electrical Power Engineering	0	3
8.6110	Structures	3	0
10.032	Mathematics	2	2
48.031	Chemical Engineering 2A	7	0
48.032	Chemical Engineering 2B	0	6
48.033	Chemical Engineering 2C	0	6
48.036	Chemical Engineering Laboratory 1	2	2
48.135	Thermodynamics	3	0
48.136	Reactor Design 1	1	2
48.163	Instrumentation and Process Control 1	0	3
	General Studies Elective	2	2
		20	26

Plus *one* of the following electives:

44.101**	Introductory Microbiology	6	0
48.039	Chemical Engineering 2J	3	3
48.321	Fuel Engineering	3	3
	Any other elective approved by Head of School		

**Students should note the special proviso for enrolment in this subject as indicated in the Subject Descriptions later in this handbook.

Year 4

48.041	Chemical Engineering 3A	4	0
48.042	Chemical Engineering 3B	4	0
48.043	Chemical Engineering 3C	3	2
48.044	Chemical Engineering Laboratory 2	3	0
48.047	Chemical Engineering 3D	2	4
	Project*	1	11
		17	17

*The project is selected from
48.040 Chemical Engineering Project
48.240 Biological Process Engineering Project
48.340 Fuel Engineering Project

		Hpw S1	S2
Plus *one* of the following:			
48.0482	Mineral Chemistry	3	3
48.113	Chemistry of Industrial Processes	3	3
48.211	Biological Process Engineering	6	6
48.331	Fuel Engineering 3	6	6
48.403	Polymer Science	3	3
48.046	Chemical Engineering Projects (additional)	6	6

Any other elective approved by Head of School.

Chemical Engineering — Subjects and Units

Students should note that there may be some rearrangement of units within subjects.

48.001	**Introduction to Chemical Industry**	2	0
48.021	**Chemical Engineering 1A**		
	Unit 1 Flow of Fluids	2	0
	2 Material and Energy Balances	1	1
	3 Dimensions and Dimensional Analysis	1	0
		6	1
48.022	**Chemical Engineering 1B**		
	Unit 1 Heat Transfer 1	0	2
	2 Computation 1	1	1
	3 Pumps and Pumping	0	1
		1	4
48.023	**Chemical Engineering Science 1 —** (Applicable to Science programs) Consists of: 48.021 *and* 48.022	5	5
48.024	**Chemical Engineering Principles 1** (Applicable to Mathematics programs) Consists of: Units 1 and 3 of 48.021 *and* Unit 1 of 48.022	3	2
48.025	**Chemical Engineering for Ceramic Engineers** Consists of: Units 1 and 3 of 48.022	0	3

		Hours per week S1	S2
48.031	**Chemical Engineering 2A**		
	Unit 1 Mass Transfer (theory)	2	0
	2 Heat Transfer 2 (theory)	1	0
	3 Plant Layout	1	0
	4 Process Engineering	1	0
	5 Safety and Failure Tolerance	1	0
	6 Economics 1	1	0
		7	0
48.032	**Chemical Engineering 2B**		
	Unit 1 Solids Handling	0	1
	2 Computation 2	0	2
	3 Engineering Thermodynamics	0	1
	4 Economics 2	0	1
	5 Surface Separation Processes	0	1
		0	6
48.033	**Chemical Engineering 2C**		
	Unit 1 Mass Transfer Design	0	1
	2 Heat Transfer 2 (Design)	0	1
	3 Process Vessels	0	1½
	4 Fluid-Particle Systems	0	2½
		0	6
48.036	**Chemical Engineering Laboratory 1**		
	Unit 1	2	0
	2	0	2
		2	2
48.037	**Chemical Engineering Science 2** (Applicable to Science programs) Consists of: Units 1 and 2 of 48.031 Units 2 and 5 of 48.032 Unit 4 of 48.033, 48.135 *and* 48.136		
		7	6
48.038	**Chemical Engineering Principles 2** (Applicable to Mathematics programs) Consists of: Units 1 and 2 of 48.031 Units 5 of 48.032 *and* Unit 4 of 48.033		
		4	2

		Hpw S1	S2
48.039	**Chemical Engineering 2J***		
	Unit 1 Electrochemical Engineering	3	0
	2 Mineral Process Engineering	3	0
	3 Computer Simulation	0	3
		6	3

*Any two units.

48.041	**Chemical Engineering 3A**		
	Unit 1 Convective Mass Transfer	1	0
	2 Simultaneous Heat and Mass Transfer	1	0
	3 Multicomponent Separation	1	0
	4 Transport Phenomena	1	0
		4	0
48.042	**Chemical Engineering 3B**		
	Unit 1 Process Dynamics and Control 1	3	0
	2 Optimization	1	0
		4	0
48.043	**Chemical Engineering 3C**		
	Unit 1 Design Workshop	1	2
	2 Industrial Pollution Control	2	0
		3	2
48.044	**Chemical Engineering Laboratory 2**	3	0
48.040	**Chemical Engineering Project**	1	11
48.047	**Chemical Engineering 3D**		
	Unit 1 Management	0	2
	2 Process Engineering 2	2	0
	3 Process Dynamics and Control 2	0	2
		2	4
48.0482	**Mineral Chemistry**	3	3
48.135	**Thermodynamics**	3	0
48.136	**Reactor Design 1**		
	Unit 1 Kinetics of Rate Processes	1	0
	2 Reaction Engineering	0	2
		1	2

		Hours per week S1	S2
48.163	Instrumentation and Process Control	0	3
48.311	Biological Process Engineering	6	6
48.240	Biological Process Engineering Project	1	11
48.311	Fuel Engineering 1*		
	Unit 1 Fuels and Energy — Sources and Properties	1	0
	2 Energy Conversion	0	1
	3 Fuel Processing	1	0
	4 Fuel Plant Technology	0	1
		2	2

*Two units each session, but are interchangeable

48.321	Fuel Engineering 2*		
	Unit 1 Combustion — Fundamentals and Science	0	1
	2 Principles of Gasification	0	1
	3 Radiation Heat Transfer and Application	1	0
	4 Measurements in Flames and Furnaces	1	0
	5 Laboratory — Fuel Testing	1	1
		3	3

*Laboratory programmed as 9 x 3 hour periods. Two lecture units each session are interchangeable.

48.331	Fuel Engineering 3		
	Unit 1 Combustion Engineering	1	0
	2 Furnace Design	1	0
	3 Fuel Plant Design	0	1
	4 Fuel Conservation and Efficiency	0	1
	5 Liquid Fuels	0	1
	6 Coal and its Evaluation	1	0
	7 Laboratory	3	3
		6	6
48.340	Fuel Engineering Project	1	11

3040
Chemical Engineering — Full-time/Part-time Course

Bachelor of Engineering
BE

The BSc(Tech) degree course in Chemical Engineering was replaced in 1975 by a part-time/full-time course leading to the award of a BE degree normally to be completed in seven years. The preferred course pattern is as follows:

Stages 1 and 2 or Year 1
Stages 3 and 4 or Year 2
Stages 5 and 6 or Year 3
Stage 7 or Year 4

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

Candidates presently enrolled in the BSc(Tech) degree course are allowed to complete their degrees as outlined in the 1974 Calendar.

Professional Electives in Course 3040 Chemical Engineering

Biological Process Engineering

The Department of Biotechnology offers a coherent professional elective in Biological Process Engineering designed for students wishing to pursue a career in the biologically based processing industries. Students electing for this professional elective should take 44.101 Introductory Microbiology in Year 3, and 48.311 Biological Process Engineering and 48.240 Biological Process Engineering Project in Year 4.

Chemical Engineering

Students wishing to pursue a career in the chemicals, petroleum, petrochemical, minerals utilization or metallurgical industries are advised to take 48.039 Chemical Engineering 2J in Year 3 and two of 7.745 Mineral Chemistry, 48.113 Chemistry of Industrial Processes, 48.403 Polymer Science together with the 48.040 Chemical Engineering Project in Year 4. Part-time students should take these subjects at equivalent stages of the part-time degree.

Fuel Engineering

The Department of Fuel Technology offers a coherent professional elective in Fuel Engineering designed for those students wishing to pursue a career concerned with fuel and energy conversion and the application of fossil fuels to the process industries. 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 and conversion, and utilization of fossil fuels. Topics include combustion science and engineering; radiation and flames; design and performance evaluation of fuel using plant such as furnaces, boilers and head recovery appliances; coal and oil conversion processes; energy conservation; and progress in fuel science and fuel processing. Students choosing this professional elective should take 48.321 Fuel Engineering 2 in Year 3 and 48.331 Fuel Engineering 3 and 48.340 Fuel Engineering Project in Year 4. Part-time students should take these subjects at equivalent stages of the part-time degree.

This elective may qualify graduates for membership of the Australian Institute of Energy or the Institute of Energy (UK).

Preferred course pattern for BSc(Tech) and BE degree courses — Full-time/Part-time

For variations to this course pattern students should contact the School.

Stage 1

		Hours per week S1	S2
1.001	Physics 1	6	6
10.001	Mathematics 1 *or*		
10.011	Higher Mathematics 1	6	6
		12	12

Stage 2

2.121	Chemistry 1A *and*		
2.131	Chemistry 1B *or*	6	6
2.141	Chemistry 1M	6	6
5.001	Engineering M	0	6
5.030	Engineering C (Includes 48.001 Introduction to Chemical Industry)	6	0
		12	12

Stage 3

2.102A	Physical Chemistry	6	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.122	Instrumental Analysis	3	3
	General Studies Elective	2	2
		15	9

Stage 4

2.102B	Organic Chemistry	2	4
48.021	Chemical Engineering 1A	4	1
48.022	Chemical Engineering 1B	1	4
48.121	Corrosion in Chemical Industry	0	2
48.311	Fuel Engineering 1*	2	2
	General Studies Elective	2	2
		11	15

*In certain cases this subject may be replaced by another elective with approval of Head of School.

Stage 5

10.032	Mathematics	2	2
48.031	Chemical Engineering 2A	7	0
48.032	Chemical Engineering 2B	0	6
48.135	Thermodynamics	3	0
48.136	Reactor Design 1	1	2
48.163	Instrumentation and Process Control	0	3
		13	13

Stage 6

		Hpw S1	S2
6.854	Electrical Power Engineering	0	3
8.6110	Structures	3	0
48.033	Chemical Engineering 2C	0	6
48.036	Chemical Engineering Laboratory 1	2	2
	General Studies Elective	2	2
		7	13

Plus *one* of the following electives:

44.101	Introductory Microbiology**	6	0
48.039	Chemical Engineering 2J	3	3
48.321	Fuel Engineering 2	3	3
	Any other elective approved by Head of School		

**Students should note the special proviso for enrolment in this subject as indicated in the Subject Descriptions later in this handbook.

Stage 7

As per Year 4 of full-time course.

3100
Industrial Chemistry — Full-time Course

Bachelor of Science
BSc

Year 1

		Hours per week
1.001	Physics 1	6
2.121	Chemistry 1A 2and	6
2.131	Chemistry 1B	
or		
2.141	Chemistry 1M	6
10.001	Mathematics 1	6
or		
10.011	Higher Mathematics	6
Plus:		
5.010	Engineering A*	6
or		
17.031	Biology A* *or*	6
25.110	Earth Materials* and Processes	6
and		
5.030	Engineering C*	6
		24

*One session only.

Year 2

1.9222	Electronics	3	0
2.102A	Physical Chemistry	6	0
2.102C	Inorganic Chemistry	0	6
2.102B	Organic Chemistry	2	4
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.122	Instrumental Analysis	3	3
48.125	Industrial Chemistry 1A	3	1
48.126	Industrial Chemistry 1B	1	3
	General Studies Elective	2	2
		24	23

Year 3

		Hours per week S1	S2
2.030	Organic Chemistry	6	0
48.113	Chemistry of Industrial Processes	3	3
48.121	Corrosion in the Chemical Industry	0	2
48.135	Thermodynamics	3	0
48.136	Reactor Design 1	1	2
48.137	Industrial Chemistry 2A	3	0
48.138	Industrial Chemistry 2B	0	3
48.139	Experimental Design	0	2
48.163	Instrumentation and Process Control 1	0	3
48.171	Chemistry of High Temperature Materials	0	2
48.172	Instrumental Analysis 2	3	0
48.403	Polymer Science	3	3
	General Studies Elective	2	2
		24	22

Year 4

18.1211	Production Management A	3	0
42.114	Fermentation Processes	0	2
48.071	Management	0	2
48.124	Applied Kinetics	2	0
48.134	Applied Thermodynamics	2	0
48.165	Laboratory Automation Science	4	0
48.174	Seminars	2	2
48.194	Project	8	16
48.404	Advanced Polymer Science	2	0
	General Studies Elective	2	2
		25	24

Plus *one* of the following:*

48.115	Industrial Electrochemistry	2
48.116	Water Chemistry	2
48.166	Microprocessors in Analytical Instrumentation	2
48.303	Fuel Science for Industrial Chemists	2

*Only one of these is offered in any one year as selected by student preferences.

3110
Industrial Chemistry — Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

Stages 1 and 2*

		Hours per week
1.001	Physics 1	6
2.121	Chemistry 1A *and*	6
2.131	Chemistry 1B *or*	
2.141	Chemistry 1M	6
10.001	Mathematics 1 *or*	
10.011	Higher Mathematics 1	6

		Hpw
Plus:		
5.010	Engineering A†	6
or		
17.031	Biology A†	6
or		
25.110	Earth Materials and Processes†	6
and		
5.030	Engineering C†	6

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

†One session only.

Stage 3

		Hours per week S1	S2
2.102A	Physical Chemistry	6	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.122	Instrumental Analysis	3	3
	General Studies Elective	2	2
		15	9

Stage 4

1.9222	Electronics	3	0
2.102B	Organic Chemistry	6	0
2.102C	Inorganic Chemistry	0	6
48.125	Industrial Chemistry 1A	3	1
48.126	Industrial Chemistry 1B	1	3
		13	10

Stage 5

48.121	Corrosion in the Chemical Industry	0	2
48.135	Thermodynamics	3	0
48.136	Reactor Design 1	1	2
48.137	Industrial Chemistry 2A	3	0
48.138	Industrial Chemistry 2B	0	3
48.139	Experimental Design	0	2
48.171	Chemistry of High Temperature Materials	0	2
48.172	Instrumental Analysis 2	3	0
	General Studies Elective	2	2
		12	13

Stage 6

2.030	Organic Chemistry	6	0
48.113	Chemistry of Industrial Processes	3	3
48.163	Instrumentation and Process Control 1	0	3
48.403	Polymer Science	3	3
		12	9

Centre for Petroleum Engineering Studies

The Centre of Petroleum Engineering has been established and a four-year course leading to the award of a Bachelor of Engineering in Petroleum Engineering commences in 1986.

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 Mechanical Engineering, Civil Engineering or Mining degree course 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 appropirately 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
6.854	Electrical Power Engineering	0	3
8.112	Structures	3	0
10.032	Mathematics	2	2
20.301	Properties and Phase Behaviour of Petroleum Reservoir Fluids	3	0
20.302	Reservoir Rock Properties and Fluid Flow in Porous Media	3	0
20.303	Well Drilling and Completions	0	3
20.304	Reservoir Engineering 1	0	3
20.305	Drilling and Production Lab	0	3
20.306	Petroleum Production Economics	1	0
20.307	Petroleum Thermodynamics	3	0
25.301	Physical Geology	3	3
25.302	Structural Geology	0	3
48.031	Chemical Engineering 2A (Units 1, 2 and 3)	5	0
48.163	Instrumentation and Process Control	0	3
	General Studies Elective	2	2
		25	25

Year 4

20.401	Reservoir Engineering 2	3	0
20.402	Reservoir Fluids Laboratory	3	0
20.403	Production Engineering	3	0
20.404	Formation Evaluation	3	3
20.405	Oil and Gas Law and Regulation	0	2
20.406	Reservoir Simulation	0	3
20.407	Advanced Recovery Methods	0	3
20.408	Natural Gas Engineering	0	3
20.409	Petroleum Engineering Project	1	10
20.410	Well Pressure Testing	2	0
48.041	Chemical Engineering 3A (Units 1 and 3)	2	0
48.042	Chemical Engineering 3B Unit 1 Control Unit 2 Optimization	4	0
48.043	Chemical Engineering 3C (Modified for Petroleum Engineers) Unit 1 Design Workshop Unit 2 Pollution Control	5	0
		26	24

School of Fibre Science and Technology

Head of School
Associate Professor J. P. Kennedy

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 an undergraduate course in Textile Technology in which there are streams in Textile Chemistry, Textile Physics, Textile Manufacture and Textile Engineering. 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 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 the rural and manufacturing industries, both of which are critically important in the economy of Australia.

Department of Textile Technology

Head of Department
Dr R. Griffith

Senior Administrative Officer (Faculty)
Mr R. F. Starr

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. Graduates with a good background in physics, chemistry or engineering, and with a broad training in the range of textile sciences and technologies, as provided in the courses in Textile Technology, will substantially meet the present and future technological requirements of the textile and allied industries. Since present day textile technology is based on engineering and the fundamental sciences, excellent opportunities also await university-trained scientists and technologists in research and development organizations. Such scientists and technologists will play a decisive part in bridging the gap which exists between fundamental research and its industrial application.

Students are given the opportunity of choosing from four courses, viz Textile Chemistry, Textile Physics, Textile Engineering and Textile Manufacture. The course in Textile Manufacture, which includes subjects in Commerce, is especially designed to meet the need for executives in industry who have been given a comprehensive technological training. Each course extends over four years. All students take a common first year, and they need not choose the option they desire to follow until the end of that year. The aim of all four courses is to produce graduates who have acquired a comprehensive knowledge of all the textile sciences and technologies, the courses themselves differing only in the subjects offered outside the School in Years 2 and 3. A period of at least 40 working days' approved industrial training is compulsory, of which at least 30 working days' training must be undertaken at the end of Year 3.

General Studies Electives

For details of changes in the General Studies requirements refer to the table earlier in this section.

3170
Textile Technology — Full-time Course

Bachelor of Science
BSc

Year 1 (All courses)		Hours per week S1	S2
1.001	Physics 1†	6	6
1.041	Laboratory Computers in Physical Sciences	6	0
2.121	Chemistry 1A	6	0
2.131	Chemistry 1B	0	6
5.001	Engineering M	0	6
9.510	**Natural Fibre Production**	**0**	**6**
10.001	Mathematics 1 *or*	6	6
10.011	Higher Mathematics 1		
13.710	**Fibre Science**	**6**	**0**
		24	24

†Students who do not qualify for entry into 1.001 Physics 1, may be allowed, at the discretion of the Head of the School, to substitute 1.021 Introductory Physics 1. Such students will be ineligible to proceed to the Textile Physics or Textile Engineering courses.

Textile Chemistry

Year 2		Hours per week S1	S2
2.102A	Physical Chemistry	0	6
2.102B	Organic Chemistry	2	4
2.102D	Analytical Chemistry	6	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
13.111	Textile Technology 1	8	8
13.211	Textile Science 1	3	3
	General Studies Elective	2	2
		25	27

Year 3			
2.003B	Organic Chemistry	6	0
2.102C	Inorganic Chemistry and Structures	0	6
13.112	Textile Technology 2	12	12
13.212	Textile Science 2	2	2
13.311	Textile Engineering 1	1	1
	General Studies Elective	2	2
		23	23

Textile Physics

Year 2			
1.002	Mechanics, Waves and Optics	4	0
1.012	Electromagnetism and Thermal Physics	0	4
1.022	Modern Physics	2	2
10.1113	Multivariable Calculus	2½	0
10.2111	Vector Calculus	2½	0
10.2112	Mathematical Methods for Differential Equations	0	2½
10.301	Statistics SA	2	2
13.111	Textile Technology 1	8	8
13.211	Textile Science 1	3	3
	General Studies Elective	2	2
		26	23½

Year 3			
1.023	Statistical Mechanics and Solid State Physics	4	0
1.062	Computer Applications in Experimental Science 2	0	5
1.9222	Electronics	3	0
13.112	Textile Technology 2	12	12
13.212	Textile Science 2	2	2
13.311	Textile Engineering 1	1	1
	General Studies Elective	2	2
		24	22

Textile Engineering

Year 2

		Hours per week S1	S2
5.0201	Engineering Dynamics 1A	3	0
5.300	Engineering Dynamics 1B	0	2
6.854	Electrical Power Engineering	0	3
7.132	Fluid Mechanics and Machines	2	2
8.1130	Engineering Drawing	3	0
10.022	Engineering Mathematics 2	4	4
10.301	Statistics SA	2	2
13.111	Textile Technology 1	8	8
13.211	Textile Science 1	3	3
	General Studies Elective	2	2
		27	26

Year 3

1.9222	Electronics	3	0
5.122	Mechanical Engineering Design 2	3	3
5.333	Dynamics of Machines	0	3
8.6110	Structures	3	0
13.112	Textile Technology 2	12	12
13.212	Textile Science 2	2	2
13.311	Textile Engineering 1	1	1
	General Studies Elective	2	2
		26	23

Textile Manufacture

Year 2

10.301	Statistics SA	2	2
13.111	Textile Technology 1	8	8
13.211	Textile Science 1	3	3
14.501	Accounting and Financial Management 1A	4½	0
14.511	Accounting and Financial Management 1B	0	4½
15.001	Microeconomics 1	3½	0
15.011	Macroeconomics 1	0	3½
	General Studies Elective	2	2
		23	23

Year 3

13.112	Textile Technology 2	12	12
13.212	Textile Science 2	2	2
13.311	Textile Engineering 1	1	1
28.012	Marketing Systems	4	0
28.052	Marketing Research	0	4
	General Studies Elective*	2	2
		21	21

*Not to include Economics.

Year 4 (All courses)

		Hours per week S1	S2
13.113	Textile Technology 3	8	7
13.213	Textile Science 3	4	4
13.312	Textile Engineering 2	1	2
13.411	Project	7	7
13.511	Seminar	1	0
	Optional*	2	2
	General Studies Elective	2	2
		25	24

*Optional Subjects

13.223	Advanced Textile Chemistry
13.233	Advanced Textile Physics
13.313	Advanced Textile Engineering
15.501	Introduction to Industrial Relations

Department of Wool Science

Head of Department
Associate Professor J. P. Kennedy

Administrative Officer
Mr J. E. Lawrence

Despite growth in the minerals industry, agricultural products still contribute a significant share of Australia's export income. Australian agriculture, and in particular the pastoral industries, has 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.

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, rangeland management and rural communications. Relevant subjects offered by other schools may also be included. An important component is the final year project whereby students engage in an area of personal research on a theoretical or experimental topic on which they are required to submit a thesis.

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

The Department also offers a course requiring one year of full-time or two years of part-time study leading to the award of the Graduate Diploma in Wool and Pastoral Sciences. Research may also be underaken for the award of the degrees of Master of Science and Doctor of Philosophy.

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.

General Studies Electives

For details of changes in the General Studies requirements refer to the table earlier in this section.

3220
Wool and Pastoral Sciences — Full-time Course

Bachelor of Science
BSc

Year 1

		Hours per week S1	S2
2.111	Introductory Chemistry *or*	6	0
2.121	Chemistry 1A	6	0
2.131	Chemistry 1B	0	6
9.510	**Natural Fibre Production**	**0**	**6**
10.001	Mathematics 1 *or*	6	6
10.011	Higher Mathematics 1 *or*	6	6
10.021B	General Mathematics 1B *and*	6	0
10.021C	General Mathematics 1C	0	6
13.710	**Fibre Science**	**6**	**0**
17.031	Biology A	6	0
17.041	Biology B	0	6
		24	24

*Up to 5 days of compulsory field excursions are part of this subject.

Year 2

2.003J	Agricultural and Biological Chemistry	6	0
9.111	Livestock Production 1*	2	2
9.201	Agronomy	3	3
9.301	Agricultural Economics and Management 1	3	3
9.501	Wool Science 1	6	6
9.601	Animal Physiology 1	0	4
10.301	Statistics SA	2	2
	General Studies Elective	2	4
		24	24

*A 5 day field excursion is an essential part of the subject.

Year 3

9.131	Animal Health 1	0	3
9.202	Pastoral Agronomy	3	3
9.421	Animal Nutrition	0	4
9.801	Genetics 1	2	3
41.101	Biochemistry	12	0
	General Studies Elective	2	4
		19	17

Plus at least one subject in Session 1 and at least two subjects in Session 2, chosen from the list of optional subjects and approved by the Head of Department.

Year 4

9.001	Project	6	6
9.002	Seminar	1	1
	General Studies Elective	2	0

Plus subjects providing at least 15 hours per week of lectures, tutorials and laboratory classes per session, chosen from the list of optional subjects. A minimum of 2 subjects in each session must be chosen from subjects in Group A. The choice of subjects is to be approved by the Head of Department who may vary the requirements in special circumstances.

Optional subjects

Group A

		Hours per week S1	S2
9.113	Livestock Production 3	3	3
9.132	Animal Health 2	3	0
9.204	Range Management*†	0	3
9.503	Wool Science 3	4	4
9.802	Genetics 2	4	4
9.811	Biostatistics 1	4	0
9.812	Biostatistics 2	0	4

*One week of instruction at Fowlers Gap Research Station is an essential part of this course.

Group B

9.112	Livestock Production 2	3	0
9.203	Crop Agronomy†	0	3
9.302	Agricultural Economics and Management 2	3	3
9.502	Wool Science 2	3	3
9.901	Rural Extension	4	4
28.012	Marketing Systems	4	0
28.052	Marketing Research	0	4
41.111	Biochemical Control	0	6
43.121	Environmental Physiology	0	6
43.142	Environmental Botany	6	0
44.101	Introductory Microbiology*	6	0
68.451	Biological Laboratory Computing	0	6

†Range Management and Crop Agronomy are offered in alternate years.

*Students should note the special proviso for enrolment in this subject as indicated in the Subject Descriptions later in this handbook.

School of Geography

Head of School
Professor B. J. Garner

Administrative Assistant
Mr P. Dunkley

Geographers study the spatial relationships of the phenomena which make up humans' physical and social environment, and aim to establish principles which govern those relationships. The geographer may concentrate on selected variables, as in systematic geography, or may deal with variables operative in 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 finding such professional employment. 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 Studies Electives

For details of changes in the General Studies requirements refer to the table earlier in this chapter.

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 geography), 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 or 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 thesis 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

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

Year 1

		Hours per week S1	S2
10.021B 10.021C 10.001	General Mathematics 1B *and* General Mathematics 1C *or* Mathematics 1 *or*	6	6
10.011	Higher Mathematics 1	6	6
27.010	Land Studies*	4	0
27.020	Locational Processes	0	4
27.030	Environmental Processes	0	4
27.040	Data Processing Systems and *either*	2	2
15.001	Microeconomics 1 *and*	3½	0
15.011	Macroeconomics 1 *and*	0	3½
27.828	Australian Social Environments	4	0
	or		
17.031	Biology A *and*	6	0
17.041	Biology B	0	6
	or		
25.110	Earth Materials and Processes** *and*	6	0
25.120	Earth Environments and Dynamics**	0	6
		19½/18	19½/22

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

**Up to 1½ days of field tutorials in 25.110 and up to 3½ days in 25.120 are essential parts of these subjects. Attendance is compulsory.

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

Applied Physical Geography

Year 2

		Hours per week S1	S2
27.050	Geographical Data Analysis	4	4
27.153	Climatology	5	0
27.183	Geomorphology*	0	5
27.825	Urban Activity Systems**	4	0
	and *one*		
	General Education Subject	0	4
	and *either*		
25.211	Earth Materials 1 *and*	6	0
25.221	Earth Materials 2***	0	6
	or any two of the following (one each session)		
43.111	Flowering Plants	6	0
43.121	Environmental Physiology	0	6
45.152	Population and Community Ecology****	6	0
45.201	Invertebrate Zoology	0	6
45.301	Vertebrate Zoology	6	0
45.601	Introductory Genetics	0	6
		19	19

*Up to 5 days field work, equivalent to 40 tutorial hours, is an essential part of this subject.
**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. 10.001 or 10.011 is a prerequisite.
Note: Students will incur personal costs in connection with the fieldwork component.

Year 3

27.133	Pedology*	5	0
27.143	Biogeography*	5	0
27.153	Climatology	0	5
27.175	Introduction to Remote Sensing	4	0
27.183	Geomorphology*	0	5
27.193	Environmental Impact Assessment	4	0
	General Studies Elective	2	2
	and *either*		
25.510	Geology for Geomorphologists and Pedologists *and*	0	5
25.622	Hydrological and Coastal Surveying	3	3
	or two of the following (one each session)		
27.176	Remote Sensing Applications‡	0	4
43.112	Taxonomy and Systematics§	0	6
43.142	Environmental Botany	6	0
43.152	Plant Community Ecology	0	6
45.121	Evolutionary Theory	6	0
45.152	Population and Community Ecology†	6	0
45.302	Vertebrate Zoogeography	0	6
		22	20
		or	
		25	22/24

‡Prerequisites for 27.176 are *either* 27.175 or 29.514 or 29.511 and 29.631.
*Up to 5 days field work, equivalent to 40 tutorial hours, is an essential part of the subject.
§Offered in alternate years.
†May be taken in either Year 2 or Year 3. 10.001 or 10.011 is a prerequisite.

Applied Economic Geography

Year 2

		Hours per week S1	S2
15.002	Microeconomics 2 *or*	4	0
15.072	Applied Microeconomics†	4	0
15.042	Macroeconomics 2 *or*	0	4
15.062	Applied Macroeconomics†	0	4
27.520	Regional Theory**	4	0
27.672	Transport and Land Use	4	0
27.050	Geographic Data Analysis	4	4
27.500	Mathematical Methods for Spatial Analysis	4	0
27.510	Project in Spatial Analysis	0	4
27.863	Ecosystems and Man	0	4
	and *one*		
	General Education Subject	0	4
		20	20

**Five days field work, equivalent to 40 tutorial hours, is a compulsory part of the subject.
†May be taken in either Session 1 or Session 2.
Note: Students will incur personal costs in connection with the fieldwork component.

Year 3

27.613	Applied Economic Geography 3A	5	0
27.623	Applied Economic Geography 3B*	0	5
27.633	Geographic Data Analysis 3	6	6
Plus *four* of the following, at least *two* subjects from Economics and at least *two* subjects from Geography**			
8.403G	Theory of Land Use/Transport Interaction‡	3	0
8.413G	Transport Economics‡	0	4
15.003	Macroeconomics 3	4	0
15.043	Marxian Political Economy	3	0
15.053	Economics of Developing Countries	0	3
15.073	Natural and Environmental Resources Economics	0	3
15.083	Public Finance	0	3
15.093	Public Sector Economics	3	0
15.143	Microeconomics 3	0	4
15.163	Industrial Organization and Policy	3	0
27.175	Introduction to Remote Sensing	4	0
27.176	Remote Sensing Applications††	0	4
27.713	Marketing Geography	0	5
27.723	Transport Geography†	0	5
27.733	Regional Policy and Planning§	0	5
27.743	Regional Population Analysis†	5	0
27.753	Social Welfare and Urban Development†	4	0
27.783	Spatial Impacts and Opportunities†	5	0
27.793	Models of Spatial Systems†	5	0
28.012	Marketing Systems†	4	0
28.052	Marketing Research†	0	4
		19	19

*Three days field work, equivalent to 24 tutorial hours, is an essential part of the subject.
†Subject to the availability of staff.
**Up to two subjects may be substituted for those listed with permission of Head of School.
‡By arrangement with Heads of Schools.
††27.175 is a prerequisite for this subject in the Applied Economic Geography program.

Human and Physical Resources

Year 2

		Hours per week S1	S2
27.050	Geographical Data Analysis	4	4
27.153	Climatology	5	0
27.183	Geomorphology*	0	5
27.520	Regional Theory*	4	0
and one			
	General Education Subject	0	4
and one of the following			
27.825	Urban Activity Systems**	4	0
27.863	Ecosystems and Man	0	4
and either			
15.062	Applied Macroeconomics*** *and*	0	4
15.072	Applied Microeconomics***	4	0
or			
25.211	Earth Materials 1 *and*	6	0
25.221	Earth Materials 2****	0	6
or two of			
43.111	Flowering Plants	6	0
45.201	Invertebrate Zoology	0	6
45.301	Vertebrate Zoology	6	0
45.601	Introductory Genetics	0	6
		17/23	23/17

*Fieldwork of up to 5 days, equivalent to 40 tutorial hours, is a compulsory part of this subject.

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

***May be taken in either S1 or S2.

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

Note: Students will incur personal costs in connection with the fieldwork component.

Year 3

27.175	Introduction to Remote Sensing	4	0
27.193	Environmental Impact Assessment	4	0
plus *five of the following subjects*†§			
27.133	Pedology**‡	5	0
27.143	Biogeography**‡	5	0
27.153	Climatology‡	0	5
27.176	Remote Sensing Applications	0	4
27.183	Geomorphology**‡	0	5
27.652	Geographic Information Systems	0	3
27.713	Marketing Geography	0	5
27.723	Transport Geography	0	5
27.733	Regional Policy and Planning	0	5
27.743	Regional Population Analysis	5	0
27.753	Social Welfare and Urban Development	4	0
and either			
15.053	Economic Development	3	0
and			
15.073	Natural and Environmental Resource Economics	0	3
or			
25.510	Geology for Geomorphologists and Pedologists and	0	6
25.622	Hydrological and Coastal Surveying	3	3

		Hpw S1	S2
or two of†			
43.112	Taxonomy and Systematics§	0	6
43.142	Environmental Botany	6	0
43.152	Plant Community Ecology	0	6
45.422	Economic Zoology	6	0
		23	16

†Appropriate subjects may be substituted with the permission of the Head of School.

§All of these subjects are offered subject to the availability of staff and a minimum number of students.

‡Offered in alternate years.

**Up to 5 days fieldwork, equivalent to 40 tutorial hours, is an essential part of this subject. Offered in alternate years.

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

Year 4

27.180	Field Project*	4	0
27.190	Assessment of Human and Physical Resources*	8	0
27.504	Project	10	16
27.514	Practical Applications	0	3
		22	19

*Up to 5 days fieldwork, equivalent to 40 tutorial hours, is an essential part of this subject. The fieldwork is normally undertaken in the week prior to the commencement of S1.

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

Geography in Other Faculties

Courses in Geography are available on a full-time basis in the Faculties of Arts and Science.

School of Materials Science and Engineering

Head of School
Professor K. E. Easterling

Clerk
Mrs E. Carlysle-Sainty

The School consists of the Departments of Metallurgy and Materials. Courses in Metallurgical Engineering and Metallurgy are offered by the Department of Metallurgy and courses in Ceramic Engineering and Ceramics are offered by the Department of Materials.

Metallurgical Engineering

The metallurgical profession has developed in importance in Australia in recent years, in keeping with the growth of our metal and mineral industries. In terms of value of production these industries are recognized as being important to Australia, especially in terms of export earnings, and there is a steady demand for professional metallurgists in all sectors of these industries, and in the manufacturing industry.

Industrial development in metallurgy has been accompanied by, and is based on, the development of metallurgical research. This is being carried on in a number of laboratories run by industry, government, and the universities.

Graduate metallurgists have a wide choice of type of employment and location. They may work in production, technical control or development, either in the ore treatment or metal extraction plants in locations such as Newcastle, Port Kembla, Broken Hill, Mt Isa, Townsville, Gladstone, Port Pirie, Whyalla, Kwinana, Kalgoorlie or Pilbara; or in the metal manufacturing plants, including the automobile, aircraft, construction and other industries, of the main centres and capital cities. In the metal industry in general the opportunities for a career in management are excellent, since it is a tradition in this industry that management should be in the hands of technical people. If 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 have been designed to prepare graduates for employment in any field of metallurgy within the metallurgical and manufacturing industries or in research institutions. The courses are broadly based on the physical sciences and on engineering commencing with studies in physics, chemistry, mathematics and engineering in the initial years. These disciplines are then applied in the later years of the courses to studies involving the extraction, refining, working, fabrication, testing and heat treatment of metals.

There are two undergraduate courses, a four-year full-time course in metallurgical engineering leading to the award of the BMetE degree and a six-year part-time course in metallurgy leading to the award of the BSc(Tech) degree. Both courses have been revised with effect from 1986.

These courses meet the formal educational requirements for admission to the professional metallurgical institutes, such as the Australasian Institute of Mining and Metallurgy and the Institution of Metals and Materials Australasia. Further details about membership of these institutes and the undergraduate Materials Society of the School, all of which students are encouraged to join, may be obtained from the Head of the School.

General Studies Electives

For details of changes in the General Studies requirements refer to the table earlier in this section.

3125
Metallurgical Engineering — New Full-time Course

Bachelor of Metallurgical Engineering
BMetE

This course extends over four years. Students attend the University for twenty-eight weeks each year excluding examination and recess periods.

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. In Year 2 two major strands of study in Physical Metallurgy and Metallurgical Engineering are introduced and these are supported by chemistry, mathematics and chemical metallurgy subjects. The two major strands are developed further in Years 3 and 4, but with the emphasis shifting from physical metallurgy to metallurgical engineering. In Year 3 the major strands are supported by other engineering subjects and in Year 4 by a thesis project, seminar and professional electives.

Students are required to have gained at least sixteen weeks of approved industrial experience before graduation, and to have submitted satisfactory reports on such work. Industrial experience is usually obtained during the long recess periods at the ends of Years 2 and 3. During 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
1.001	Physics 1	6	6
2.121	Chemistry 1A	6	0
2.131	Chemistry 1B	0	6
5.001	Engineering M*	2	4
5.030	Engineering C†	4	2
10.001	Mathematics 1 *or*		
10.011	Higher Mathematics 1	6	6
		24	24

Year 2			
2.102A	Physical Chemistry	6	0
4.412A	Physical Metallurgy 1A	6	0
4.422B	Physical Metallurgy 1B	0	2
4.432	Physical Metallurgy 1C	0	4
4.442	Physical Metallurgy 1D	0	3
4.612	Metallurgical Engineering 1A	3½	0
4.622	Metallurgical Engineering 1B	0	3½
4.632	Metallurgical Engineering 1C	4	0
4.642	Metallurgical Engineering 1D	0	2
7.725	Chemical and Extraction Metallurgy 1	0	3
10.031	Mathematics	2	2
	General Studies Elective	2	2
		23½	21½

Year 3

		Hours per week S1	S2
4.413	Physical Metallurgy 2A	2½	0
4.423	Physical Metallurgy 2B	4	0
4.433C	Physical Metallurgy 2C	4	0
4.443	Physical Metallurgy 2D	0	4
4.453	Physical Metallurgy 2E	0	2½
4.613A	Metallurgical Engineering 2A	3	0
4.623B	Metallurgical Engineering 2B	0	3½
4.633	Metallurgical Engineering 2C	3½	3½
4.643	Metallurgical Engineering 2D	0	3
6.854	Electrical Power Engineering	0	3
7.023	Mineral Process Engineering	2	0
7.735	Chemical and Extraction Metallurgy 2	3½	0
	General Studies Elective	0	4
		22½	23½

Year 4

4.024	Metallurgy Project	6**	3
4.044	Professional Electives	5	5
4.054	Materials Seminar	2	2
4.414	Physical Metallurgy 3A	2	0
4.424	Physical Metallurgy 3B	2	0
4.434	Physical Metallurgy 3C	0	3
4.614	Metallurgical Engineering 3A	2	0
4.624B	Metallurgical Engineering 3B	3	0
4.634	Metallurgical Engineering 3C	3	0
4.644	Metallurgical Engineering 3D	0	4
4.654	Metallurgical Engineering 3E	0	4
	General Studies	0	4
		25	25

**Project includes 84 hours of laboratory work during the mid year recess.
*Includes 4.001 Introduction to Materials Engineering.
†Includes 4.002 Introduction to Metallurgical Engineering.

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 day of release from industry per week may be required. The course essentially covers the same subject matter as the first three years and part of Year 4 of the full-time metallurgy course and involves the same major strands of study in Physical Metallurgy and Metallurgical Engineering. In the later stages of the course, there is less emphasis on primary metallurgy than in the full-time course and there is more emphasis on secondary Metallurgical Engineering which is developed to Year 4 level, while Physical Metallurgy is taken to Year 3 level. Students are required to complete an approved program of industrial training of not less than twelve months prior to the award of the degree. Industrial training should normally be completed concurrently with attendance in the course, but with the approval of the Head of School may be completed after completion of the prescribed course of study.

Stage 1

		Hours per week S1	S2
1.001	Physics 1	6	6
10.001	Mathematics 1 *or*	6	6
10.011	Higher Mathematics 1*		
		12	12

Stage 2

2.121	Chemistry 1A	6	0
2.131	Chemistry 1B	0	6
5.001	Engineering M†	6	0
5.030	Engineering C‡	0	6
		12	12

*There are no evening lectures in this subject.
†This subject includes 4.001 Introduction to Materials Engineering.
‡This subject includes 4.002 Introduction to Metallurgical Engineering.

Stage 3

2.102A	Physical Chemistry	6	0
4.302	Chemical and Extractive Metallurgy 1	0	3
4.422B	Physical Metallurgy 1B	0	2
4.442	Physical Metallurgy 1D	0	3
4.612	Metallurgical Engineering 1A	3½	0
10.031	Mathematics	2	2
	General Studies Elective	2	2
		13½	12

Stage 4

1.9222	Electronics	3	0
4.412A	Physical Metallurgy 1A	6	0
4.432	Physical Metallurgy 1C	0	4
4.622	Metallurgical Engineering 1B	0	3½
4.632	Metallurgical Engineering 1C	4	0
4.642	Metallurgical Engineering 1D	0	2
	General Studies Elective	0	4
		13	13½

Stage 5

4.413	Physical Metallurgy 2A	2½	0
4.423	Physical Metallurgy 2B	4	0
4.443	Physical Metallurgy 2D	0	4
4.453	Physical Metallurgy 2E	0	2½
4.613A	Metallurgical Engineering 2A	3	0
4.633	Metallurgical Engineering 2B	3½	3½
4.643	Metallurgical Engineering 2C	0	3
		13	13

Stage 6

4.034	Industrial Metallurgy Project	4	2
4.054	Materials Seminar	2	2
4.433C	Physical Metallurgy 2C	4	0
4.624B	Metallurgical Engineering 3B	3	0
4.644	Metallurgical Engineering 3D	0	4
4.654	Metallurgical Engineering 3E	0	4
6.854	Electrical Power Engineering	0	3
		13	15

Ceramic Engineering and Ceramics

The Department of Materials offers a four-year full-time course in Ceramic Engineering leading to the award of the BE degree and a six-year part-time course in Ceramics leading to the award of the BSc(Tech) degree.

The ceramic industry produces an enormous volume and variety of products used in engineering applications, building construction and in our everyday life. As well as the traditional bricks, roof tiles, sheet and container glass and tableware, ceramics have been found essential as abrasives, refractories, enamels and in electrical and electronic applications and nuclear fuels. In many of these cases, ceramic articles make possible the manufacture of other products either by being a key component, such as an electronic or magnetic part, or by forming the material of construction of, for example, a blast furnace or an abrasive wheel.

Modern ceramics comprise such a varied and complex group of materials that a high level of training is required to control their manufacture with the required precision and to supervise their proper use. Ceramic engineers are needed in increasing numbers both in Australia and overseas countries and the 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 management if they have an interest in this side of the industry.

In Australia, a number of government research organizations are active in ceramic research, eg the Australian Atomic Energy Commission Research Establishment, 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.

3025
Ceramic Engineering — Full-time Course

Bachelor of Engineering
BE

Year 1

		Hours per week S1	S2
1.001	Physics 1	6	6
2.121	Chemistry 1A	6	0
2.131	Chemistry 1B	0	6
5.001	Engineering M	2	4
5.030	Engineering C	4	2
10.001	Mathematics 1 *or*		
10.011	Higher Mathematics 1	6	6
		24	24

		Hpw S1	S2
Year 2			
1.9322	Physics (Introduction to Solids)	0	3
2.102A	Physical Chemistry	0	6
2.102C	Inorganic Chemistry	0	6
2.102D	Analytical Chemistry	6	0
4.232	Ceramic Engineering 1	3	0
7.023	Mineral Process Engineering	2	0
8.6110	Structures	3	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
25.523	Mineralogy	2	2
	General Studies Elective	2	2
		23	24
Year 3			
1.9222	Electronics	3	0
4.213	Chemical Ceramics	6	5
4.233	Ceramic Process Principles	3½	3½
4.823	Numerical Methods	1½	1½
48.021	Chemical Engineering 1A*	4	1
48.025	Chemical Engineering for Ceramic Engineers	0	3
48.135	Thermodynamics	3	0
48.163	Instrumentation and Process Control 1	0	3
48.311	Fuel Engineering 1	2	2
	General Studies Elective	0	4
		23	23

*Additional 14 hours bridging course for students not having done 48.001.

Year 4			
4.054	Materials Seminar	2	2
4.224	Physical Ceramics	6	6
4.234	Ceramic Engineering	4	4
4.294	Project (Ceramic Engineering)	6	9
48.047	Chemical Engineering 3D Unit 1 Management	0	2
48.049	Automation and Optimization for Ceramic Engineers	4	0
	General Studies Elective	2	2
		24	25

3030
Ceramics — Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

Stages 1 and 2*

		Hours per week S1	S2
1.001	Physics 1	6	6
2.121	Chemistry 1A	6	0
2.131	Chemistry 1B	0	6
5.001	Engineering M	6	0
5.030	Engineering C	0	6
10.001	Mathematics 1 *or*	6	6
10.011	Higher Mathematics 1	6	6

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

Stage 3		Hours per week S1	S2
2.102A	Physical Chemistry	0	6
2.102D	Analytical Chemistry	6	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
		10	10
Stage 4			
1.9322	Physics (Introduction to Solids)	0	3
2.102C	Inorganic Chemistry	0	6
4.232	Ceramic Engineering 1	3	0
7.023	Mineral Process Engineering	2	0
8.6110	Structures	3	0
25.523	Mineralogy	2	2
	General Studies Elective	2	2
		12	13
Stage 5			
1.9222	Electronics	3	0
4.233	Ceramic Process Principles	3½	3½
48.021	Chemical Engineering 1A*	5	0
48.025	Chemical Engineering for Ceramic Engineers	0	3
48.163	Instrumentation and Process Control 1	0	3
	General Studies Elective	0	2
		11½	11½

*Additional 14 hours bridging course for students not having done 48.001.

Stage 6			
4.054	Materials Seminar	2	2
4.213	Chemical Ceramics	6	5
4.823	Numerical Methods	1½	1½
48.135	Thermodynamics	3	0
48.311	Fuel Engineering 1	2	2
	General Studies Elective	0	2
		14½	12½

School of Mines

Head of School
Professor F. F. Roxborough

Administrative Assistant
Mr R. Rolls

The School consists of three Departments corresponding to the three main professions on which the mining and minerals industry of Australia depends. These are the Departments of Applied Geology, Mining Engineering, and Mineral Processing and Extractive Metallurgy. Prior to the formation of the School in 1986, Applied Geology and Mining Engineering were separate Schools and Mineral Processing and Extractive Metallurgy (sometimes referred to as Mineral Engineering) was spread among several other Schools in the Faculty. Bringing the three together into the School is an important development in mining industry education in Australia, and has resulted in one of the largest and best equipped centres of its kind in the world.

Geologists, mining engineers and mineral engineers (mineral processors/extractive metallurgists) work closely together in the mining industry. The geologist is responsible for discovering new mineral resources and for defining the size, value and other relevant factors, such as natural site conditions, that may affect their extraction. In the light of this information, the mining engineer decides if the deposit is worth mining, designs the mine and thereafter manages it throughout its operational life. The mineral 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 of these technical specialists is an expert in their 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 mineral engineers to study and interact together, while at University, in preparation for their necessarily close involvement with each other during subsequent careers.

Separate degree courses are available in each of the Departments, as described below. Students enrol in the Department of their choice and many activities are departmentally centred, but others are school-based to provide a corporate identity with the mining and allied industries and with associated consultancies and engineering groups.

Department of Applied Geology

Head of Department
Associate Professor P. R. Evans

Senior Administrative Officer
Mr G. J. Baldwin

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.

Two different professional courses are offered by the Department, each of four years duration and leading to a BSc degree at Pass or Honours level. The long-established BSc degree course in Applied Geology provides a comprehensive education in all aspects of earth science, with emphasis on the skills and applications required for professional practice of geology in the mineral industry, construction and development, or related areas. Graduates are prepared by the course to enter any branch of the geological profession, and to change their area of employment as different opportunities arise.

The BSc degree course in Mining Geology equips students more specifically for employment as geologists in the mining industry. It provides an opportunity for more detailed study of the engineering behaviour of rock materials in mining and mineral processing, and enables graduates to become more closely involved with mine design, production planning and the economic assessment of mining projects.

No previous knowledge of geology is required to enter these courses, but a sound background in Mathematics, together with Physics and/or Chemistry is essential.

A three-year full-time course in Geology, and courses that combine a single major in Geology with Physics, Chemistry, Mathematics, or Botany and Zoology, and courses that combine Geology with Geophysics and Geography are available to students in the Faculty of Science. Provision is also made for part-time study in the first year of Geology within that Faculty. Selected students in the Faculty of Science may study for an Honours degree in Geology.

Master of Applied Science degree courses in Engineering Geology, Hydrogeology, Environmental Geology, Mineral Exploration, Exploration Geochemistry and Exploration Geophysics are offered on a part-time or a full-time basis. The courses are designed to provide specialized training in practical applications of these fields.

General Studies Electives

For details of changes in the General Studies requirements refer to the table earlier in this chapter.

3000
Applied Geology — Full-time

Bachelor of Science
BSc

Year 1

		Hours per week S1	S2
1.001	Physics 1	6	6
2.121	Chemistry 1A	6	0
2.131	Chemistry 1B	0	6
10.001 10.011 10.021B 10.021C	Mathematics 1 *or* Higher Mathematics 1 *or* General Mathematics 1B *and* General Mathematics 1C	6	6
25.110	Earth Materials and Processes*	6	0
25.120	Earth Environments and Dynamics*	0	6
		24	24

*Up to 2 days of field tutorials in 25.110 Earth Materials and Processes and up to 4 days in 25.120 Earth Environments and Dynamics are essential parts of these subjects. Attendance is compulsory.

Year 2

25.211	Earth Materials 1**	6	0
25.212	Earth Environments 1**	6	0
25.221	Earth Materials 2***	0	6
25.223	Earth Physics*	0	6
25.2261	Mathematical Geology 1	0	3
	General Studies 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

		Hpw S1	S2
25.311	Earth Materials 3	6	0
25.321	Earth Materials 4*	0	6
25.312	Earth Environments 2**	6	0
25.333	Exploration Geophysics	3	2
25.3162	Mathematical Geology 2	3	0
25.314	Mineral and Energy Resources 1***	6	0
25.324	Mineral and Energy Resources 2*	0	6
25.325	Engineering and Environmental Geology***	0	6
25.3261	Geochemical Analytical Techniques	0	2
25.3271	Structural Geology*	0	2
	General Studies 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

		A	S1§ B	S2
25.410	Resource Geology*	12	4	
25.420	Field Project			24
25.4101	Topics in Advanced Geology		6	
		12	10	24

and either

A. Mineral Resources strand, consisting of

		S1§ A	B
7.013	Principles of Mining	2	2
7.044	Mining Economics	4	4
25.4141	Mineral Exploration	5	
25.4142	Geological Sampling and Analytical Methods**		4
25.4143	Research Project		5
		11	15

or

B. Sedimentary Basin Resources strand, consisting of

		S1§ A	B
25.4121	Advanced Sedimentology	7	7
25.4122	Seismic Stratigraphy and Log Analysis		4
25.4123	Geology of Selected Oil and Gas or Coal Fields	4	
25.4124	Palynology or Foraminiferal Micropalaeontology		4
		11	15

or

C. Engineering and Environmental Geology strand, consisting of

		S1§ A	B
25.4151	Hydrogeology	3	3
25.4152	Engineering Geology	3	3
25.4153	Environmental Geology	3	3
25.4154	Engineering Geology Project	2	6
		11	15

		Hours per week S1§ A	B
or			
D. Geophysics strand**, consisting of			
25.4122	Seismic Stratigraphy and Log Analysis		4
25.9311	Gravity and Magnetic Methods	3	3
25.9312	Seismic Methods	3	3
25.9313	Electrical Methods	3	3
25.9315	Regional Geophysics		2
and either			
25.4141	Mineral Exploration	5	
or			
25.4123	Geology of Selected Oil and Gas or Coal Fields	4	
		13/14	15

§Session 1 is divided into 2 segments of 7 weeks each. Hours listed under A apply to weeks 1-7; those under B apply to weeks 8-14.
*Field work of up to 7 days is a compulsory part of this subject.
**Field work of up to 3 days is a compulsory part of the subject of the strand.

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Mining Geology — Full-time

Bachelor of Science
BSc

Year 1

		Hours per week S1	S2
1.001	Physics 1	6	6
2.121	Chemistry 1A	6	0
2.131	Chemistry 1B	0	6
10.001	Mathematics *or*		
10.011	Higher Mathematics	6	6
25.110	Earth Materials and Processes*	6	0
25.120	Earth Environments and Dynamics**	0	6
		24	24

*Up to 2 days of compulsory field tutorials are part of this subject.
**Up to 4 days of compulsory field tutorials are part of this subject.

Year 2

5.001	Engineering M	6	0
5.0201	Engineering Dynamics	0	3
5.030	Engineering C	6	0
7.011	Stress Analysis in Mining 1	0	3
7.142	Mine Development	1	1
25.211	Earth Materials 1*	6	0
25.221	Earth Materials 2**	0	6
25.223	Earth Physics*	0	6
25.2261	Mathematical Geology 1	0	3
25.5212	Sedimentary Environments***	2	0
	General Studies Elective	2	2
		23	24

*Field work of up to 1 day is a compulsory part of this subject.
**Field work of up to 4 days is a compulsory part of this subject.
***Field work of up to 5 days is a compulsory part of this subject.

Year 3

		Hpw S1	S2
7.113	Mining Methods	2	2
7.123	Geomechanics	4	4
7.213	Mine Surveying	2	0
25.314	Mineral and Energy Resources 1*	6	0
25.3162	Mathematical Geology 2	3	0
25.324	Mineral and Energy Resources 2**	0	6
25.325	Engineering and Environmental Geology*	0	6
25.3271	Advanced Structural Geology	0	2
25.333	Exploration Geophysics	3	2
25.5311	Aqueous Geochemistry****	0.7	0
25.5312	Geological Field Mapping§	1.5	0
	General Studies Elective	2	2
		24.2	24

*Field work of up to 3 days is a compulsory part of this subject.
**Field work of up to 4 days is a compulsory part of this subject.
****10 hours total during Session 1 only.
§This subject comprises an 8 day field tutorial with associated assignments.

Year 4*

7.114	Geotechnical Engineering	2	2
7.214	Mine Economics and Planning	4	4
7.424	Industrial and Research Seminars	1	1
25.410	Resource Geology**	6	0
25.4101	Topics in Advanced Geology	3	0
25.4141	Mineral Exploration	2.5	0
25.4142	Geological Sampling and Analytical Methods	2	0
25.4143	Research Project	2.5	0
and either			
25.542	Mining Geology Project†		
or			
7.425	Mining Geology Project††	0	18
		23	25

*Includes a mandatory work experience period of at least 100 days before graduation.
**Field work of up to 7 days is a compulsory part of this subject.
†Offered by the Department of Applied Geology.
††Offered by the Department of Mining Engineering.

Department of Mineral Processing and Extractive Metallurgy

Head of Department
Associate Professor R. G. Robins

Mineral Engineering comprises those professional activities required for the extraction of valuable components from mined ore, and their conversion into refined metals and similar products used in the manufacturing industries. Graduates from the Mineral Engineering degree course are capable of the professional activities of research and development, design and commissioning of processes and plants, and operation and supervision of production plants in the mineral industry.

The mineral industry is diverse in scope, scale and location. It produces refined metals, constructional materials, coal and coke, and a wide variety of other products such as chemicals, ceramics, abrasives and paints. Every mineral deposit has some unique characteristics that influence the extraction processes. Also each deposit is limited in quantity, consequently new ones must be continually investigated and developed. There is, therefore, a progressive challenge to mineral engineers to improve extraction methods and develop new techniques.

The Department offers an undergraduate course of four years duration leading to the award of a BE degree at pass or honours level. This course meets the formal requirements for admission to the professional mining and metallurgical institutions.

The Mineral Engineering course is based on a broad spectrum of mathematics, physics, chemistry, geology, mineralogy and chemical engineering, and specializes in mineral processing, extractive metallurgy and process plant design.

A Master of Applied Science degree course in Mineral Engineering is also offered.

3126
Mineral Engineering — Full-time Course

Bachelor of Engineering
BE

		Hours per week S1	S2
Year 1			
1.001	Physics 1	0	6
2.121	Chemistry 1A *and*	6	0
2.131	Chemistry 1B	0	6
5.001	Engineering M	0	6
5.030	Engineering C*	6	0
10.011	Higher Mathematics 1 *or*		
10.001	Mathematics 1	6	6
		18	24

*This subject includes 7.610 Introduction to Mining and Mineral Engineering.

Year 2			
2.102A	Physical Chemistry	6	0
7.621	Mineral Engineering Science 1	0	3
7.622	Mineral Engineering 1	3	3
7.623	Mineral Engineering Laboratory 1	0	3
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
25.520	Geology for Mining Engineers 1	2	2
48.021	Chemical Engineering 1A		
	Unit 1 Heat Transfer 1	0	2
	Unit 2 Computations	1	1
	Unit 3 Dimensions and Dimensional Analysis	1	0
48.301	Fuel Engineering	3	3
	General Studies Elective	2	2
		22	23
Year 3			
4.972	Materials for Mining Engineers	2	2
6.854	Electrical Power Engineering	0	3
7.113	Mining Methods	2	2
7.631	Mineral Engineering Science 2	5	0
7.632	Mineral Engineering 2	3	3
7.633	Mineral Engineering Laboratory 2	3	3
10.032	Mathematics	2	2
25.523	Mineralogy	2	2
48.031	Chemical Engineering 2A		
	Unit 1 Mass Transfer Theory	2	0
	Unit 2 Heat Transfer 2 (Theory)	1	0
48.136	Reactor Design	1	2
48.163	Instrumentation and Process Control 1	0	3
	General Studies Elective	2	2
		25	24
Year 4			
7.214	Mine Economics and Planning	4	4
7.642	Mineral Engineering 3	6	6
7.643	Mineral Engineering Projects and Laboratory	6	9
48.041	Chemical Engineering 3A		
	Unit 2 Simultaneous Heat and Mass Transfer	1	0
	Unit 4 Transport Phenomena	1	0
48.042	Chemical Engineering 3B		
	Unit 2 Optimization	1	0
	Professional Electives	3	3
	General Studies	2	2
		24	24

Professional Electives: Appropriate subjects to the total of six session hours may be nominated. A list of some such subjects is available from the Head of School.

3140
Mining Engineering — Full-time Course

Bachelor of Engineering
BE

Year 1 of the course is essentially the same as that for 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 a personal research or 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
1.001	Physics 1	6	6
2.951	Chemistry (ME)	6	0
5.001	Engineering M	6	0
5.0201	Engineering Dynamics	0	3
5.030	Engineering C†	0	6
7.011	Stress Analysis in Mining 1	3	
10.001	Mathematics 1 *or*		
10.011	Higher Mathematics 1	6	6
		24	24

†Incorporates 7.111, Introduction to Mining and Mineral Engineering. Visits to mines and related undertakings are a requirement of this subject.

Year 2

1.9222	Electronics	3	0
4.972	Materials for Mining Engineers	1½	1½
6.854	Electrical Power Engineering	0	3
7.132	Fluid Mechanics and Machines	2	2
7.142	Mine Development†	1	1
7.012	Stress Analysis in Mining 2	4	0
8.6130	Properties of Materials	2	2
10.022	Engineering Mathematics 2	4	4
10.301	Statistics SA	2	2
25.520	Geology for Mining Engineers‡	2	2
29.441	Surveying for Engineers	0	6
29.491	Survey Camp	0	0
	General Studies Elective	2	2
		23½	25½

†Visits to mines and related undertakings are a requirement of this subject.
‡Includes two compulsory field tutorials.

Year 3

7.113	Mining Methods†	2	2
7.123	Geomechanics	2½	2½
7.133	Mine Transport	0	2½
7.143	Mine Environment and Safety Engineering‡	2	2
7.153	Power Supply in Mines	2½	0
7.163	Excavation Engineering	2	2
7.173	Computer Applications in Mining	2	2
7.213	Mine Surveying	2	0
7.433	Mining Laboratory	3	3
7.7342	Minerals Engineering Processes	3	3
25.530	Geology for Mining Engineers 2§	4	4
	General Studies Elective	2	2
		27	25

†Visits to mines and related undertakings are a requirement of this subject.
‡Includes field training in mine-rescue and recovery.
§A geology field excursion is held at the end of Session 1.

Year 4

		Hours per week S1	S2
7.114	Geotechnical Engineering	2	2
7.174	Mining Legislation	1	1
7.214	Mine Economics and Planning	4	4
7.224	Operational Management	2	2
7.414	Minerals Industry Project	4	4
7.424	Industrial and Research Seminars	1	1
7.434	Advanced Mining Laboratory	1	1
	General Studies Elective	2	2

together with an approved grouping† of 3 subjects selected from the following

4.374	Metal Extraction Processes	2	2
7.124	Coal Face Mechanization*	2	2
7.144	Surface and Offshore Mining	2	2
7.154	Petroleum Engineering	2	2
7.184	Underground Metalliferous Mining*	2	2
7.194	Tunnel Engineering and Shaft Sinking	2	2
7.744	Mineral Process Technology	2	2
48.301	Fuel Engineering	2	2
		23	23

†Approval for a group of subjects must be obtained from the Head of School and must include *at least one* of the subjects marked *

Department of Mining Engineering

Head of School
Professor F. F. Roxborough

Administrative Assistant
Mr R. Rolls

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.

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.

Formal graduate programs include Master of Applied Science (MAppSc) degree course in Mining Geomechanics. This course is available by external correspondence only and is chiefly designed for professionals working in geographically remote areas in the mining industry.

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.

General Studies Electives

For details of changes in the General Studies requirements refer to the table earlier in this section.

Undergraduate Study:

Subject Descriptions

Identification of Subjects by Number

A subject is defined by the Professorial 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'.

Each approved subject of the University is identifiable both by number and by name as this is a check against nomination of subject other than the one intended.

Subject numbers are allocated 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 number before the decimal point.

2. Each subject number 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.

4. Graduate subjects are indicated by a suffix 'G' to a number with three digits after the decimal point. In other subjects three or four digits are used after the decimal point.

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.

The identifying numerical prefixes for each subject authority 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 the General Studies subjects. For General Studies subjects see the **General Studies 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 (Sesion 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)
- C (Credit *or* Credit units)
- CR (Credit Level)
- DN (Distinction)

Physics

Physics Level I Units

1.001 Physics 1 — F L3T3

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics or*	*71-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100 or*
and	*(for 1.001 only) 10.021B*
2 unit Science (Physics) or	*31-100*
2 unit Science (Chemistry) or	*31-100*
4 unit Science (Multistrand)	*31-100*

Co-requisite: 10.021C or 10.001 or 10.011.

*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, energy 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.

1.021 Introductory Physics 1 (For Health and Life Scientists) — F L3T3

Prerequisites: None. Co-requisites: 10.021A and 10.021B, or 10.021B and 10.021C, or 10.001 or 10.011.

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.

Physics Level II Units

1.002 Mechanics, Waves and Optics — S1 L3T1

Prerequisites: 1.001 or 1.011, 10.001 or 10.011. Co-requisite: 10.2111. Excluded: 1.992, 10.4111, 10.4211.

Harmonic motion, systems of particles, central force problems, Lagrange's equations, coupled oscillations, travelling waves, pulses, energy and momentum transfer, polarization, birefringence, interference, thin films, gratings, lasers, holography, fibre optics, Faraday effect, photoelasticity.

1.012 Electromagnetism and Thermal Physics — S2 L3T1

Prerequisites: 1.001 or 1.011, 10.001 or 10.011. Co-requisite: 10.2111. Excluded: 1.972, 1.992.

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.

1.022 Modern Physics — FL1½T½

Prerequisites: 1.001 or 1.011, 10.001 or 10.011. Co-requisite: 10.2112. Excluded: 1.9322, 1.982.

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, fission and fusion, nuclear forces.

1.062 Computer Applications in Experimental Science 2 — S1 L2T3

Prerequisite: 1.061. Excluded: 1.042.

Interface between computer and experiment, programmed and interrupt interaction, direct and dual port memory access concepts, hardware, software and timing restraints. Real-world variables, transducers and conversion to binary representation, converters and counters, signals and noise. Data collection, reduction and storage as digital matrices. Numerical modelling, analysis and elementary control of a system.

1.9222 Electronics — S1 L1T2

Prerequisites: 1.001 or 1.001 or 1.021. Excluded: 1.032.

The application of electronics to other disciplines. Includes: principles of circuit theory and analogue computing; amplifers, their specification and application, transducers; electronic instrumentation; industrial data acquisition.

1.9322 Introduction to Solids — S2 L2T1

Prerequisites: 1.001 or 1.011 or 1.021. Excluded: 1.022, 4.402, 4.412.

Introductory quantum mechanics and atomic physics; crystal structure; point and line defects; introductory band theory; conductors, semi-conductor and insulators; energy level diagrams.

Physics Level III Units

1.023 Statistical Mechanics and Solid State Physics **S1 L3T1**

Prerequisites: 1.012, 1.022, 10.2112.

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.

Chemistry

2.103B Organic Chemistry **S1 L3T3**

Prerequisite: 2.102B. Excluded: 2.003B.

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 monocyclic 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.

2.003J Fundamentals of Biological and Agricultural Chemistry **S1 L2T4**

Prerequisites: 2.121 and 2.131, or 2.141. Excluded: 2.013L, 41.101.

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.

2.030 Organic Chemistry **S1 L2T4**

Prerequisite: 2.002B.

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.

2.043L Chemistry and Enzymology of Foods **L2T4**

Prerequisite: 2.002B. Excluded: 2.003J, 2.043L.

The chemistry of food constituents at an advanced level and the relationship between the chemistry and enzymology associated with the origin and handling of foodstuffs. Treatment of the stability of constituents, changes in colour and texture occurring during processing and storage. Methods of assessment, chemical and physical. General classification of constituents, role of free and combined water. Fixed oils and fats, rancidity of enzymic and autoxidative origin, antioxidants — natural and synthetic — theories on mechanisms of action, carbohydrates, reactivity, role in brewing processes, carbohydrate polymers, starch structure, enzymic susceptibility and mode of action, estimations, enzymic degradation and enzymic browning, reactions and stability of natural pigments, vitamins, preservatives.

2.102A Physical Chemistry **S1 or S2 L3T3**

Prerequisites: 2.121 and 2.131, or 2.141; and 10.011 or 10.001 or 10.021B and 10.021C. 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.

2.102B Organic Chemistry **F or S2 L3T3**

Prerequisite: 2.131 or 2.141. 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.

2.102C Inorganic Chemistry and Structure **S1 or S2 L3T3**

Prerequisites: 2.121 and 2.131, or 2.141. 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.

2.102D Chemical and Spectroscopic Analysis — S1 or S2 L3T3

Prerequisites: 2.121 and 2.131, or 2.141; and 10.011 or 10.001 or 10.021B and 10.021C. 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.

2.111 Introductory Chemistry — S1 L2T4

Prerequisite: Nil.

Note: Students who have passed 2.121 or 2.131 may not enrol in 2.111 or 2.141. Students meeting the 2.121 or 2.141 prerequisite are not permitted to enrol in 2.111 without the permission of the Head of the School of Chemistry. Students who enrol in 2.111 must pass 2.111 before they can proceed to 2.121 or 2.131 or 2.141.

Classification of matter and the language of chemistry. The gas laws and the ideal gas equation, gas mixtures and partial pressure. The structure of atoms, cations and anions, chemical bonding, properties of ionic and covalent compounds. The periodic classification of elements, oxides, hydrides, halides and selected elements. Acids, bases, salts, neutralization. Stoichiometry, the mole concept. Electron transfer reactions. Qualitative treatment of reversibility and chemical equilibrium, the pH scale. Introduction to the diversity of carbon compounds.

2.121 Chemistry 1A — S1 or S2 L2T4

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics or*	*71-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100*
and	
2 unit Science (Physics) or	*31-100*
2 unit Science (Chemistry) or	*31-100*
4 unit Science or	*31-100*
3 unit Science or	*31-100*
2.111.	

*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).

Stoichiometry and solution stoichiometry. Properties of gases; kinetic molecular theory. Thermochemistry. Atomic structure, electron configurations and the periodic table. Types of chemical bonds, electronegativity, molecular geometry. Periodicity of physical and chemical properties of common representative elements and compounds. Liquids and solids, changes of state, phase diagrams. Types of solids. Solutions and their properties. Colloids. Facts and theories about reaction kinetics.

Note: Students who have passed 2.121 or 2.131 may not enrol in 2.111 or 2.141. Students meeting the 2.121 or 2.141 prerequisite are not permitted to enrol in 2.111 without the permission of the Head of the School of Chemistry. Students who enrol in 2.111 must pass 2.111 before they can proceed to 2.121 or 2.131 or 2.141.

2.123E Environmental Chemistry — S2 L3T3

Prerequisites: 2.102A and 2.102D. Excluded: 2.043A.

Physico-chemical aspects of the environment. Factors affecting the chemistry of rivers, estuaries, oceans, surface and sub-surface waters. 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.

2.131 Chemistry 1B — S1 or S2 L2T4

Prerequisite: 2.121.

Chemical equilibrium, equilibrium constants, quantitative calculations applied to acid-base and solubility equilibria; buffers, titrations, chemical analysis. Oxidation and reduction reactions, electrode potentials. Chemical thermodynamics, entropy, free energy. Chemistry of carbon compounds, stereoisomerism; alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, aldehydes, ketones, carboxylic acids and derivatives, amines.

Note: Students who have passed 2.111 may be permitted to enrol in 2.131 on application to the Head of the School of Chemistry.

2.141 Chemistry 1M — F L2T4

Prerequisites:

	HSC Exam Percentile Range Required
*2 unit Mathematics**	*71-100*
3 unit Mathematics	*21-100*
4 unit Mathematics	*1-100*
and	
2 unit Science (Chemistry) or	*51-100*
4 unit Science or	*51-100*
3 unit Science	*51-100*
or	
2.111	

*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).

Note: As for *Note,* 2.121 Chemistry 1A.

The syllabus is an integrated one of 2.121 and 2.131 (see above). Students majoring in Chemistry may take 2.141 in lieu of 2.121 and 2.131.

2.951 Chemistry 1ME — S2 L3T3

Prerequisite: As for 2.121.

A treatment of chemistry which illustrates the application of the principles of chemistry to problems of concern to mechanical engineers. Topics: chemistry of materials, thermochemistry, chemical kinetics and equilibrium, radioactivity and nuclear power, electrochemistry and corrosion of metals. Introduction to organic chemistry, structure and properties of polymers, fuels and lubricants. Surface chemistry.

Materials Science and Engineering

4.001 Introduction to Materials Engineering **S1 or S2 L1**

Forms part of 5.010 Engineering A.

Metals, ceramics, polymers and composites, their structure, chemical, physical and mechanical properties, engineering applications and production, with particular reference to Australian industries.

4.003 Introduction to Computing **S2 L2**

Forms part of 5.030 Engineering C. For students in courses 3025, 3030, 3125 and 3130.

Introductory computing. Outline of computer architecture. Features of common computing languages, syntax, structure, variable typing, portability. Basic syntax. Common numerical techniques, function evaluation, numerical integration, solution of simultaneous linear equations, Monte Carlo techniques; assignments involving application of these techniques.

4.024 Metallurgy Project **S1 6 S2 3**

An experimental investigation of some aspects of metallurgy. Includes three weeks laboratory work during the mid-year recess.

4.034 Industrial Metallurgy Project **S1 4 S2 2**

An experimental investigation of some aspects of industrial metallurgy.

4.044 Professional Electives **F5**

4.054 Materials Seminar **F L2**

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. Organization and direction of conferences. Traditional and on line retrieval of information. Each student is required to prepare and present a paper on a nominated subject.

4.204 Ceramic Materials Selection **S1 or S2 L2**

Classification of ceramic materials. Structure-property relations. Mechanical properties; effects of grain size, porosity. Transformation toughening. Thermal and chemical toughening of glass. Glass ceramics. Nitrogen ceramics. Thermal properties; thermal stress resistance, refractories. Ferroelectric, piezoelectric components. Porcelain enamels.

4.213 Chemical Ceramics **S1 L3T3 S2 L2T3**

Prerequisites: 2.002A, 2.002C, 2.002D. Co- or prerequisites: 4.233, 48.135, 25.541.

Structural principles: crystal chemistry, structure of glasses, defect solid state: phase equilibria and transformations; diffusion; solid state reactions. A systematic treatment of the chemistry of ceramic products.

Students are required to take part in a series of factory inspections.

4.224 Physical Ceramics **F L2T4**

Prerequisites: 4.213, 4.233.

Application of the principles of physical chemistry and solid state physics to a study of the preparation and properties of ceramic materials and components. Mechanical, thermal, electrical and magnetic properties. Nucleation and spinodal decomposition. Solid electrolytes. Mechanisms of sintering and vitrification. Techniques for particle size and surface area determination and the identification of clay minerals.

4.231 Introduction to Ceramic Engineering **S2 L2**

The nature of ceramics. The scope of ceramic industry. The origin, classification, physical properties and uses of clay minerals and other non-clay raw materials. Principal unit operations used in the ceramic industry. Drying and firing of ceramics, melt forming, hot forming and other forming procedures.

4.232 Ceramic Engineering 1 **S1 L3**

The principles of operation, construction and fields of application of equipment used in the mining, preparation and fabrication of raw materials, and the drying and firing of ceramic products.

4.233 Ceramic Process Principles **F L1T2½**

Review of raw materials and principal unit operations used in the ceramic industry. Plasticity in a clay-water system. Drying and firing calculations. Polymorphism. Firing and heat transfer considerations. Effect of porosity on fired 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. Testing methods and instrumentation in quality control.

Students are required to take part in a series of factory inspections.

4.234 Ceramic Engineering 2 **F L2T2**

Prerequisites: 4.232, 4.233, 8.112, 48.021, 48.025.

Advanced treatment of fluid flow and heat transfer: non-Newtonian fluids and unsteady-state heat transfer. A detailed study of ceramic engineering unit operations: filtration, forming, drying and firing. Ceramic engineering design including design of dryers, kilns and glass tanks. Design of simple steel structures. Pollution control equipment.

Students are required to take part in a series of factory inspections.

4.294 Project (Ceramic Engineering) **S1 T6 S2 T9**

An experimental or technical investigation or design related to some aspect of ceramic engineering. Prerequisites and/or co-requisites are determined depending on the nature of the project.

4.412 Metallurgical Phases — Structure and Equilibrium, Part 1 **S1 L3T3**

Co-requisites: 2.002A, 4.302. Excluded: 1.9322, 4.402.

The crystal structure of metallic phases. Crystal defects. Physical properties of solids. Phase equilibrium in alloy systems. The genesis of microstructure. Metallography.

4.412A Physical Metallurgy 1A **S1 L3**
Unit 1: Phase Equilbria I

Co-requisite: 2.102A, 4.632.

Elements of crystallography. The crystal structure of metallic phases. Defect structures, dislocations, grain boundaries, plasticity, deformation and recrystallization. Phase equilibrium in alloy systems. Genesis of microstructure. Mechanisms of phase transformations, departure from equilibrium, metastable transition phases. Use of free energy principles to determine nature of phase equilibrium, common tangent construction. Application of Hume-Rothery principles to determine liquidus and solidus boundaries, electron compounds. Introduction to nucleation theory.

Unit 2: Phase Equilibria Laboratory **S1 T3**

Elementary founding principles. Solidification processes in moulds. Metallography of non-ferrous alloys.

4.413 Physical Metallurgy 2A **S1 L1 T1½**

Prerequisite: 4.412A.

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 base alloys.

4.414 Physical Metallurgy 3A **S1 L2**

Prerequisite: 4.433C.

Studies of diffusional and martensitic phase transformations. Diffusional metastable transition phases, special reference to ageing of commercial alloys, Guinier-Preston zones, coherent and semi-coherent precipitates. Metastable solvus boundaries, reversion. General properties of martensitic transformations; relationship between stress and transformation, thermoelastic behaviour. Shape-memory alloys. Nucleation and kinetics of ferrous martensites. Morphology and strengthening characteristics of ferrous martensites, ausforming and maraging steels. Introduction to crystallographic theory of martensitic transformations. Introduction to coincident site theory, O lattice theory of interface structures; grain boundaries, recrystallization, interphase boundaries.

4.422B Physical Metallurgy 1B **S2 L1T1**

Metallographic techniques. Principles of optical microscopy. Quantitative microscopy and stereology.

4.423 Physical Metallurgy 2B **S1 L2T2**

Prerequisite: 4.412A.

X-ray, electron optics and texture. Principles of electron optics. Transmission and scanning electron microscopy. Energy dispersive and wavelength dispersive X-ray spectroscopy. X-ray fluorescence spectroscopy. On-stream analysis. Principles of X-ray diffraction. Powder and single crystal X-ray methods. Stereographic projections and crystal geometry, X-ray fluorescence. Scanning and transmission electron miscroscopy. Measurement and description of preferred orientations. Textures produced by deformation in wires and rolled metals. Pure metal and alloy rolling textures and annealing textures. Theories of texture development.

4.424 Physical Metallurgy 3B **S1 L½T1½**

Prerequisite: 4.423.

Intensity of diffracted X-ray beams. Geometry of diffraction. Reciprocal lattice. Ewald sphere construction. Application to X-ray and electron diffraction. Contrast in thin foil transmission electron microscopy. Application to imaging of stacking faults, dislocations and precipitates.

4.432 Physical Metallurgy 1C **S2 L1T3**

Prerequisite: 4.412A

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

4.433C Physical Metallurgy 2C **S1 L2½T1½**

Prerequisite: 4.412A.

Theory of plasticity of metals. Introduction to dislocation theory and its application to mechanical properties of alloys. 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.

4.434 Physical Metallurgy 3C **S2 L2T1**

Prerequisite: 7.735.

Structure and properties. Application of the chemistry of the defect solid state to materials preparation and reactivity. Non stoichiometry and stoichiometry dependent physical and chemical properties of metal compounds. Structure and properties of ionic and metallic melts.

4.442 Physical Metallurgy 1D **S2 L2½T½**

Prerequisite: 1.001 or 1.011.

Metallurgical physics. Application of quantum mechanics to the development of models of metallic phases. Sommerfield theory, zone theory. Mechanisms of conductivity, semiconduction, magnetism. Origin of alloy structures. BASIC syntax. Programs involving Monte Carlo techniques and solution of linear and non-linear simultaneous equations; applications to diffusion and phase equilibria.

4.443 Physical Metallurgy 2D **S2 L2T2**

Prerequisite: 4.432.

Diffusion in the solid state, Kirkendall effect, mechanisms. Fick's laws, solutions. Grain boundary, surface and dislocation pipe diffusion. Precipitation, nucleation and growth of isolated precipitates. Co-operative precipitation, pearlite, discontinuous precipitation. Proposed laws governing growth rates, maximum velocity, maximum rate of entropy production. Hardenability. Effect of alloying elements on pearlite growth rates. Grossman and Jominy tests, calculation of depth of hardening. Development of stresses during quenching, retained stress, distortion, quench cracking.

4.444 Advanced Crystallography of Phase Transformations **S1 or S2 L1**

Co- or prerequisite: 4.414.

Advanced crystallography of phase transformations. Martensite crystallographic theory applied to ferrous martensites, generalization of lattice invariant shear, dilatation. Application of coincident site theory. O lattice theory to generalized phase boundary structure. Crystallography of Widmanstatten precipitates.

4.453 Physical Metallurgy 2E **S2 L1T1½**

Prerequisite: 4.432.

Alloy steels. Ternary equilibria involving iron and carbon. Metallography and properties of alloys steels. Effect 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.

4.494 High Temperature Techniques **S1 or S2 L1**

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

4.612 Metallurgical Engineering 1A **S1 L1T2½**

Fluids. Applications of principles of fluid flow to primary and secondary metallurgical practice. Course examples are drawn from metallurgical engineering practice in the broadest sense. Corrosion in marine heat exchangers. Energy conservation in the selection of fluid meters for blast furnaces. Float-out of non-metallic inclusions in steel melts. Erosion and emptying rates of BOF vessels. Metal tapping from furnaces. Ladle-to-ladle vacuum degassing. Corrosion in the liquid metal coolant circuit of a fast breeder reactor. Sinter strands. Blast furnace hanging. Gas entrainment in falling metal streams. Metallurgical applications of fluidized beds. Particulate removal from process off-gases.

4.613A Metallurgical Engineering 2A **S1 L2T1**

Prerequisite: 4.622.

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 BOF vessels and ladles. Slab cooling in hot strip mills. Interaction of free and submerged gas jets with melts. Accretion stability, back wall and tuyere erosion. Continuous casting. Solidification in metal and sand moulds. Solute transference between liquid metals and slags. Vacuum and magnesium desulphurization of steel melts. Lead softening. Cementation. Role of line and point defects on reactivity.

4.614 Metallurgical Engineering 3A **S1 L1T1**

Prerequisite: 4.613A.

Kinetics and mass transfer in metallurgial processes. Kinetics of interphase transfer in metallurgical systems. Single particle, fluid/solid reactions, topochemical reactions, reactions of porous solids. Application to reduction of iron oxides. Reaction between liquid metals and gases, reactions involving drops and bubbles. Reaction between liquid metals and slags, mass transfer at bubble stirred interfaces. Application to metal refining processess. Vacuum degassing and refining processes.

4.622 Metallurgical Engineering 1B **S2 L1T2½**

Prerequisite: 4.612.

Heat. Applications of principles of steady and unsteady state heat transfer to primary and secondary metallurgical practice. Course examples are drawn from metallurgical engineering practice in broadest sense: Heat treatment of metals. Water-side corrosion in heat exchangers. Continuous casting. Aluminium smelting, electroslag refining, liquid metal-cooled nuclear reactors. Refining zinc in the Imperial Smelting Furnace. Gas cooling system for arc furnace fume collection. Economic thickness of kiln walls.

4.623B Metallurgical Engineering 2B **S2 L3T½**

Prerequisite: 2.002A.

Electrometallurgical engineering. Thermodynamics, kinetics and electrochemistry of aqueous solutions, potential-pH diagrams and other stability diagrams. Application to hydrometallurgy, corrosion, corrosion prevention and electrodeposition and electropolishing. Contacting of metallurgical phases, batch and continuous contacting. Application to design of leaching systems and reduction of metal oxides. 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. Electrodeposition, growth morphology, electropolishing.

4.624B Metallurgical Engineering 3B **S1 L3**

Prerequisite: 4.632.

Mechanical and thermal processing. Mechanisms of deformation. Origin of rolling and annealing textures. Inhomogeneities of deformation. Texture control and controlled rolling. Application to transformer steel, HSLA steel, deep drawing 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.

4.632 Metallurgical Engineering 1C **S1 L2T2**

Prerequisite: 5.010. 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.

4.633 Metallurgical Engineering 2C **F L2T1½**

Prerequisites: 10.001 or 10.011, 4.442.

Mathematical methods. **1.** 10.351 Statistics SM (see Engineering Handbook). **2.** Numerical methods. Finite difference and finite element techniques and their application to metallurgical phenomena involving diffusional transport, elasticity and plasticity.

4.634 Metallurgical Engineering 3C **S1 L2½T½**

Prerequisite: 4.453.

Advanced materials. 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. 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. Fibre composites, Fibre and matrix materials, fabrication. Design with fibre composites. Mechanical properties and environmental effects, corrosion, fatigue, creep and damage tolerance. Mechanisms of sintering in metals. Techniques of powder metallurgy; compaction, powder characteristics. Sintering in presence of liquid phase, cementation, cermets. Preparation of super-alloys.

4.642 Metallurgical Engineering 1D **S2 L1T1**

Prerequisite: 4.632.

Metal forming. Introduction to metal forming operations. Factors affecting deformation and workability. Processes of forging, rolling, extrusion, and wire drawing. Die materials and geometry. Deformation parameters and processing defects.

4.643 Metallurgical Engineering 2D **S2 L2T1**

Prerequisites: 4.412A, 4.632.

Fracture mechanisms. Classification of macroscopic and microscopic fracture mechanisms in metals. Initiation and propagation of ductile, brittle, fatigue, creep, stress-corrosion and corrosion-fatigue fracture. Effect of metallurgical defects and design deficiencies on origin and cause of fracture. Analysis of various modes of fracture using metallographic and scanning transmission electron fractographic techniques. Studies of case histories of engineering service failures.

4.644 Metallurgical Engineering 3D **S2 L2T2**

Prerequisite: 4.453.

Welding engineering. Welding metallurgy, welding of structural steels, Q and T steels, stainless steels. Welding of aluminium alloys. Welding codes and standards. Welding processes, SMAW, GMAW, FCAW, SAW. Resistance welding, robotic welding. Electron-beam welding, laser welding. Non-destructive testing, X-ray and gamma radiography, ultrasonic and eddy current testing.

4.654 Metallurgical Engineering 3E **S2 L1T3**

Prerequisites: 4.633, 4.643.

Engineering design. Engineering design codes of practice, experimental and theoretical stress analysis and fracture mechanics. Design codes and statutory regulations with emphasis on selection of materials for service conditions. Design approaches to fatigue and brittle fracture are treated in terms of contemporary rules for approaches to fatigue and dynamic loading and low temperature service. Stress analysis component is presented in terms of both experimental techniques and numerical analysis using finite element computer programs. Emphasis in laboratory classwork is on electrical resistance strain gauge techniques but other techniques are also applied. Quantitative design against fracture in terms of linear elastic fracture mechanics and elastic plastic fracture mechanics using COD and J integral approaches is presented with reference to case studies.

4.664 Surface Treatments and Wear **S2 L1T1**

Prerequisite: 4.623B.

Coatings for corrosion prevention, engineering and decorative purposes. Specifications for coating systems. Electrochemical and other metallic coatings. Non-metallic coatings. Selection, testing and evaluation of coatings. Classification of wear modes. Mechanisms of adhesive and abrasive wear. Selection, testing and evaluation of materials for wear mitigation. Wear-resistant materials, wrought and cast steels, cast iron, hard-facing and non-metallic materials.

4.674 Mathematical Plasticity **S2 L1**

Prerequisite: 4.633.

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.

4.684 Transport Phenomena in Metallurgical Processes **S1 or S2 L1**

Co- or prerequisite: 4.614.

Control of many metallurgical processes and design of suitable plant depend on an appreciation of factors affecting rate of reaction. In many cases, especially when conditions are far from equilibrium, transport of heat and/or mass is rate limiting.

Deals with application of transport processes (fluidised flow, heat and mass transfer) to a number of typical processes. Illustration from: iron-making, steelmaking, combustion, fluidized bed processing, leaching, solvent extraction, vacuum processing.

4.694 Air Pollution control in the Metallurgical Industry **S1 or S2 L½T½**

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

4.823 Numerical Methods **F L1T½**

Prerequisite: 10.031.

Consists of Unit 2 — Numerical Methods of 4.813 Mathematical Methods.

4.913 Materials Science **F L2T1**

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.

4.964 Materials Science and Engineering for Electrical Engineers **S2 L3T1**

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.

4.972 Materials for Mining Engineers **F L1T½**

Solidification of metals, structure and defects in castings and welds. Hard-facing techniques, powder metallurgical processes. Phase equilibrium in alloys and application to engineering materials. Non-equilibrium, heat treatment and modification of structure and properties. Elastic and plastic deformation. Mechanical processing. Fracture. Corrosion and corrosion protection in mining environments. Specification and selection of engineering materials.

Mechanical and Industrial Engineering

5.0011 Engineering Mechanics 1 **S1 or S2 L2T2**

Prerequisite:

	HSC Exam Percentile Range Required
Either	
2 unit Science (Physics) or	*31-100*
4 unit Science (multistrand)	*31-100*
or	
2 unit Industrial Arts or	*31-100*
3 unit Industrial Arts	*11-100*

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-planar 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.

5.0012 Introductory Engineering Design and Materials Science **S1 or S2 L2 T0**

Excluded: 5.0016, 5.010.

Introduction to Engineering Design: Engineering method, problem identification, creative thinking, mathematical modelling; computer-aided design; materials and processes; communication of ideas; the place of engineering in society.

Introduction to Materials Science: Structure and properties of main types of engineering materials, with emphasis on the way in which properties may be controlled by controlling structure.

5.0201 Engineering Dynamics 1A **S1 or S2 L/T3**

Prerequisite: 5.010 or 5.0101. Excluded: 5.0011.

Kinematics of a particle in the plane: rectilinear and curvilinear motion; motion relative to a translating frame of reference. Kinetics of a particle in the plane: Newton's second law; D'Alembert's principle; work, power and energy. Virtual work. Kinetics of a system of particles: impulse and momentum; moment of momentum; equations of motion; impact. Fixed-axis rotation of a rigid body: angular momentum; equation of motion; moment of inertia; energy; centre of percussion. Steady mass flow.

5.030 Engineering C **S1 or S2 L2T4 or L/T6 or F L/T3**

Prerequisite: as for 5.0011. Excluded: 5.0016, 5.0302.

Engineering Drawing: Graphic communication. First and third angle orthographic projection and isometric projection. Descriptive geometry fundamentals and their application to engineering problems with special emphasis on visualization of problems and development of methods for their solution. Australian standard engineering drawing practice. Applications involving detail and assembly drawings, functional dimensioning and tolerancing.

and one of the following options (determined by the course of study).

1. *Production Technology* S2 L/T3
(Mechanical, Industrial and Aeronautical Engineering and Naval Architecture students must take this option.) Description and appraisal of the processes classified as: forming from liquid or solid, material removal, material joining. Machines. Analysis of the primary functions of the machine tools and an appraisal of their limitations. Principles of operation of common machine tools and illustrations of their use.

2. *Introduction to Chemical Industry*
(Chemical Engineering and Industrial Chemistry students must take this option.) The chemical industry in Australia. The role of professional societies. Special topics on the engineering and chemical aspects of the industry, ie pollution control, energy sources, food and biochemicals and polymers, mineral processing, safety, etc. A visit to a factory in the Sydney area and the preparation of a short report after an introduction to information retrieval by university librarians.

3. *Introduction to Metallurgical Engineering*
(Metallurgy students must take this option.) History and significance of the exploitation of metals. Ores, mineral economics, mineral processing, and metal extraction and processing methods illustrated by reference to the Australian mineral and metal industries. Properties, uses and applications of metallic materials. The role of the metallurgist in industry and in processing and materials research, and in relation to conservation and the environment.

4. *Introduction to Mining Engineering*
(Mining Engineering students must take this option.) Mineral deposits; metallic, non-metallic and fuels. Elements of prospecting and exploration. Basic mining techniques. Mining phases: development, exploitation, beneficiation and withdrawal. Mining and the environment. Mining services. Relevance of basic science and engineering subjects to mining design and operations.

5. *Introduction to Ceramic Engineering*
(Ceramic Engineering students take this option.) The classification of materials. The nature of ceramics. The materials science approach. The scope of the ceramic industry. The origin, classification, physical properties and uses of clay minerals and other non-clay raw materials. Principal unit operations used in the ceramic industry. Drying and firing of ceramics, melt forming, pot forming and other forming procedures.

5.0302 Engineering Drawing and Descriptive Geometry **S1 or S2 L1T3**

Excluded: 5.0016, 5.030.

Graphic communication. First and third angle orthographic projection and isometric projection. Descriptive geometry fundamentals and their application to engineering problems with special emphasis on visualization of problems and development of methods for their solution. Australian standard engineering drawing practice. Applications involving detail and assembly drawings, functional dimensioning and tolerancing.

5.122 Mechanical Engineering Design 2 **F L1T2**

Prerequisites: 5.010, 5.030. Co-requisites: 5.0201, 5.061, 5.422, 5.620, 5.626.

Design of basic engineering elements and simple systems. Selection and specification of materials and manufacturing processes for engineering items. Communication by means of engineering drawings (including tolerances) of manufacturing information for simple structures and assemblies. Application of standards and trade literature to design. Simple design-and-make project to meet a published specification and to demonstrate the product's performance.

5.300 Engineering Dynamics 1B **S2 L1T1**

Prerequisites: 1.001 or 1.951, 5.0201, 10.001 or 10.011.

Kinematics and kinetics of rigid bodies in planar motion: absolute motion and motion relative to translating and rotating frames of reference; constraint and degrees of freedom; friction; extensions to Newton's second law; D'Alembert's principle; differential equations of motion; gyroscopic couple; work and energy, variational principles; impulse and momentum, impact.

Electrical Engineering and Computer Science

6.611 Computing 1 **S1 or S2 L3T3**

Prerequisite: As for 10.001. Co-requisite: 10.001 or 10.011. Excluded: 6.600, 6.620, 6.021D (1.041 excluded for students enrolled in Program 6806 and Computer Science programs in the Science and Mathematics course).

Introduction to programming: design and correctness of algorithms and data structures; programming in a high-level algorithmic language which provides simple, high level program control and data structuring facilities. Problem solving: basic ideas of problem solving; introduction to abstract structures used for computing solutions to problems. Introduction to propositional logic, computing machinery, computer arithmetic, artificial intelligence, and operating systems.

6.621 Computing 2A **S1 or S2 L3T2**

Prerequisites: 6.611, 10.001 or 10.011. Excluded: 6.620, 6.021D.

For those students who intend to take further subjects in computer science.

Expansion and development of material introduced in 6.611 Computing 1. Systematic program development: introduction to programming language semantics, reasoning about programs, program derivation, abstract programs, realization of abstract programs (conversion from abstract to concrete). Practice in programming in a high-level programming language. Data-structures: arrays, lists, sets, trees; recursive programming. Introduction to computer organization: a simple machine architecture. Introduction to operating systems.

6.854 Electrical Power Engineering **S2 L2T1**

Prerequisite: 1.001 or equivalent (1.9222 or 6.851 for students in Course 3140).

Extensive introduction to the theory and application of heavy current electrical engineering. Commences with the requisite circuit theory and then proceeds to consideration of the distribution of electrical power and the characteristics and selection of electrical machinery. DC power supplies, three-phase AC supply, voltage regulation, transformers, AC and DC machines and their rating; a project illustrating the application of electrical engineering to various aspects of industry. Consists of two 2-hour tutorial or laboratory sessions per week each commencing with a structured mini-lecture. Detailed lecture notes are provided.

Mining Engineering and Mineral Processing and Extractive Metallurgy

Mining Engineering and Mineral Processing and Extractive Metallurgy are Departments within the School of Mines.

7.011 Stress Analysis in Mining 1 **S2 L1T2**

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.

7.012 Stress Analysis in Mining 2 **S1 L2T2**

Prerequisite: 7.011.

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.

7.013 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.

7.044 Mining Economics — S1 L2T2

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.

7.111 Introduction to Mining and Mineral Engineering — S2 L2

Forms part of 5.030 Engineering C.

Mineral deposits: metallic, non-metallic and fuels. Elements of prospecting and exploration. Basic mining techniques. Mining phases: development, exploitation, beneficiation and withdrawal. Mining and the environment. Mining services. Unit operations of mineral processing and extractive metallurgy. Disposal of waste material. Relevance of basic science and engineering subjects to mining and mineral engineering.

7.113 Mining Methods — F L2

Prerequisite: 7.142.

Types of occurrence; stratified and non-stratified deposits. Production development for underground and surface mines. Surface mining of coal, metalliferous ores and other minerals. Offshore and marine mining. Non-entry methods. Underground coal mining: partial and total extraction systems. Pillar, shortwall and longwall mining. Special methods for thin, thick and steeply inclined seams. Simultaneous mining and multiple seams. Working seams in close proximity. Underground metalliferous mining. Underhand and overhand techniques. Classification of stoping methods: open stopes, filled stopes and caving. Secondary mining. Utilization and disposal of mine waste.

7.114 Geotechnical Engineering — F L1T1

Prerequisites: 7.123, 7.113, 7.433.

Determination of in-situ rock properties. Field instrumentation. Correlation of laboratory and field data. Structural surveys. Design of underground and surface mine openings. Magnitude and distribution of stresses. Modelling techniques. Initiation and propagation of failure in rock structures. Excavation stability; natural and artificial support, permanent and temporary support. Design of support systems. Slope stability. Ground control measurements. Rockbursts. Outbursts in coal. The effects, prediction and control of mining subsidence.

7.123 Geomechanics — F L2T½

Prerequisite: 10.001. Co-requisites: 7.433, 10.301 or 10.331.

Review of stress and strain analysis. Stress tensors. Rheological models. Failure criteria. Classification systems for rocks and rock masses. Engineering properties of rocks and soils. Deformability, time, size and geometry dependent characteristics. Strength, dynamic properties, effects of pore water, permeability, bearing capacity. Strain measurement. Sampling and laboratory testing. Interpretation of data.

7.124 Coal Face Mechanization — F L1T1

Physical and mechanical properties of in-situ and broken coal. Coal cutting mechanics. The principles of shearing, planing, milling and trepanning applied to production and development machines. Methods of assessing the cuttability of coal seams. Mechanization problems in thin, thick, steep and faulted seams. The stability, steering and control of face machines. The coal clearance sub-system. Face bunkerage. Face support systems. Packing and stowing. Manning and supervision. Materials and supplies. Performance criteria. Transferability and mobility of face equipment. Integration of production sub-systems of components.

7.132 Fluid Mechanics and Machines — F L2

Prerequisites: 1.001 or 1.011 or 1.951, 5.010, 5.0201, 10.001. Co- or prerequisites: 7.011 or 8.171, 10.022.

Dimensional theory. Fluid properties. Hydrostatics. Equations of flow. Fluid flow in pipes, ducts and channels. Flow over weirs and notches. Energy balances and losses. Fluid jets. Principles of hydraulic and gas engines and associated equipment. Refrigeration and airconditioning.

7.133 Mine Transport — S2 L2T½

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 ropeways, 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.

7.142 Mine Development — F L1

Selection of mining site. Geographic communications, transport links and services. Methods of exploratory and development boring. Provision of primary access, shaft sinking, drifts, adits and box cuts. Sinking and driving through water-bearing and unconsolidated ground. Temporary and permanent methods of supporting mine entries. The provision of shaft-bottom, inset and sublevel installations. Surface requirements for winding, hoisting, ventilation and drainage. Surface layout. Engineering, administration and welfare facilities. Environmental considerations, surface structures, spoil and effluent disposal. Land restoration, mining community requirements.

7.143 Mine Environment and Safety Engineering — F L2

Prerequisites: 7.132, 7.142. Co-requisite: 7.433.

Natural and artifical ventilation. Air requirements. The design and analysis of ventilation networks. The characteristics, operation and installation of mine fans. Auxiliary ventilation systems. Psychrometry. Heat and humidity control in deep mines. Mine gases. Liquid and metallic poisons, their origins, detection, monitoring and control. Airborne dust sources and suppression. Physiological effects of vitiated and contaminated air. Spontaneous combustion, fires, explosions and inundations. Rescue and recovery. Mine water control and drainage. Pumping installations. Noise measurement and control. Illumination requirements. Design of mine lighting installations. Laws relating to safety and health. Study of accidents and methods of improving safety.

7.144 Surface and Offshore Mining — F L1T1

Opencast mining of coal and bedded deposits. Open pit mining for irregular and inclined deposits. Quarrying. Scale of operations, stripping ratio. Overburden removal, special blasting methods. Shovel, dragline and excavator calculations. Loading and haulage. Ground stability considerations, slopes, inclines and spoil heaps. Bench geometry. Haulage roads and tracks. Groundwater control. Climatic effects. Site restoration. Stream and offshore 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.

7.153 Power Supply in Mines — S1 L2T½

Prerequisites: 1.9222 or 6.851, 7.132.

Electrical power generation, distribution and control. Transformers and rectifiers. Motor characteristics. Starting and switching. Mine cables. Flame proofing and intrinsic safety. Signalling and communications. Compressed air: generation, distribution, applications and equipment. Compressors and receivers. Oil hydraulic power. Fluid characteristics. Emulsions, inverts and non-flammable oils. Components and circuits. Pumps, motors, valves. Speed and torque control.

7.154 Petroleum Engineering — F L1T1

Properties of liquid and gaseous petroleum. Exploration techniques. Elements of reservoir engineering. Drilling rigs. Cable tool, rotary and down the hole drilling. Bit design. Other drilling methods. Drilling fluids and muds. Directional drilling. Coring, core-analysis and logging. Well cementing and casing. Suction rod pumping. Well simulation.

7.163 Excavation Engineering — F L1T1

Rock drilling and boring. Percussive, rotary, hybrid and exotic methods. Drilling patterns for shafts, headings, faces and benches. Classification 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 wear and fracture resistance. Methods of assessing rock cuttability. The design of cutting arrays for machine mining.

7.173 Computer Applications in Mining — F L1T1

Prerequisite: 10.022.

FORTRAN programming. Simulation of mining problems. Application of selected programs to mining exploration, operations, economics and design.

7.174 Mining Legislation — F L1

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

7.184 Underground Metalliferous Mining — F L1T1

Not available to students who have completed 7.134. Prerequisite: 7.133.

Shaft and incline location and capacity. Disposition and dimensions of levels and main development openings. Cyclic and continuous production systems. System components and their integration. Optimum fragmentation. Ore and waste rock clearance. Location of ore passes. Flowability and degradation of ores. Draw control and loading. Pillar recovery. Preparation and placement of mine fills. Bulkhead design and dewatering of fill. Stope access and services. Crushing and storage of ores underground. Production and development scheduling. Multi-face production systems.

7.194 Tunnel Engineering and Shaft Sinking — F L1T1

Not available to students who have completed 7.164.

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.

7.213 Mine Surveying — S1 L1T1

Prerequisites: 10.301, 29.441.

Surveying methods applied to the development and extraction of minerals. Instruments of special value in mine surveying. Correlation of underground and surface surveys. Progress measurement. Determination of reserves. The surveying and logging of boreholes. Preparation of mine plans.

7.214 Mine Economics and Planning — F L2T2

Prerequisite: 7.113.

Aspects of micro- and macro-economics Theory and practice of resource sampling. Valuation of mineral properties and mining projects. Investment decision analysis, cash flow models. Sensitivity analysis. Marketing of minerals. Type of companies, private, public, no-liability, state ownership and participation. Financing of mining ventures. Contracts and project assessment. Selection procedures for systems and equipment. Obsolescence and replacement. Maintenance planning. Manpower planning, standards of performance, control of projects and technical reporting.

7.224 Operational Management — F L1T1

Elementary industrial psychology. Work measurement. Design of jobs and work methods. Incentive and remuneration. Trade Unions. Communications and consultation. Disputes, conciliation and arbitration. Recruitment, selection and training of operators and supervisors. Mine management structure and organization. Management of change. Operations research: control networks, decision analysis, linear programming, queueing theory, simulation, improvization. Management accounting and budget control. Grade control, estimation of cut-off grades. Purchasing and stores policies. Statutory responsibilities of management and mine officials.

7.234 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.

7.414 Minerals Industry Project **F T4**

Candidates are required to submit a dissertation or thesis on a mining, minerals engineering or other topic approved by the Head of School. The work may take the form of an engineering analysis, experimental investigation, theoretical study or design project. Candidates may be required to present themselves for oral examination on the subject of their submission.

7.424 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.

7.425 Mining Geology Project **S2**

7.433 Mining Laboratory **FT3**

Co-requisites: 7.123, 7.143.

A program of laboratory experiments for Year 3 students requiring the submission of appropriate laboratory reports and related to the syllabus areas of the co-requisite subjects.

7.434 Advanced Mining Laboratory **F T1**

Prerequisite: 7.433.

A program of mining laboratory experiments for Year 4 students, requiring the submission of appropriate laboratory reports.

7.610 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.

7.621 Mineral Engineering Science 1 **S2 L2T1**

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 mattes. Application to combustion of fuels, roasting, chlorination, reduction of oxides, smelting of sulphides and refining of metals.

7.622 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 achievements. Overall 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.

7.623 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 benefication and subsequent refinement or utilization.

7.631 Mineral Engineering Science 2 **S1 L5**

Unit 1 Physical and Chemical Characterisation of Mineral Particiles

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 Hydrometallurgical Processes

Application of principles of aqueous thermodynamics, electrochemistry, chemical and electrochemical kinetics, to hydrometallurgical 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.

7.632 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 2 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.

7.633 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 programme. 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.

7.642 Mineral Engineering 3 **F L3T3**

Unit 1 Control and Simulation

Problems in the automatic control and on-line analysis of mineral and metallurgical processess.

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.

7.643 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.

7.714 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.

7.725 Chemical and Extractive Metallurgy 1 **S2 L2T1**

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.

7.734 Mineral Process Engineering **S1 L2T1**

7.7341 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.

7.7342 Minerals Engineering Processes **F L1T2**

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.

7.735 Chemical and Extractive Metallurgy 2 **S1 L2T1½**

Metallurgical thermodynamics. Thermodynamic behaviour 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 quasi chemical model of solutions. Free energy-composition and phase diagrams of binary systems, alternative standard states, relationship between 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.

7.744 Mineral Process Technology **F L1T1**

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.

7.746 Mineral Chemistry **F L2T1**

The fundamental principles of metal extraction. Oxidation and reduction, roasting, slag reactions, distillation, leaching, precipitation and electrolysis. Sources of equilibrium stability data, methods of presenting stability data for application to interpreting the chemical reactions and mechanisms of aqueous processes.

7.7451 Advances in Pyrometallurgy **S1 or S2 L2**

Advances in pyrometallurgy related to extraction and refining processes used for recovery of ferrous and non-ferrous metals.

7.7452 Advances in Hydrometallurgy **S1 or S2 L1T1**

A critical analysis of: recent industrial and research developments in extraction metallurgy; major problems that are the subjects of current research and development in extractive metallurgy: the variety of methods available for research and development.

7.748 Technical Decision Making **S1 or S2 L1T1**

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.

Civil Engineering

8.1130 Engineering Drawing **S1 L1T2**

Fundamental concepts of descriptive geometry, orthographic drawing, first and third angle drawing, isometric and perspective drawing, Australian standard engineering and drawing practice, application of descriptive geometry to common problems in civil engineering, graphic communications, introduction to computer graphics.

8.6110 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.

8.6130 Properties of Materials **F L1T1**

Mechanical behaviour of materials. Response to static loading in tension, compression, shear and bending. Use of static test data in analysis and design; variability of material properties; factors of safety. Hardness tests. Creep in solid materials. Response to dynamic loading; fatigue; impact. Deterioration of engineering materials. Rheological classification of materials.

Wool Science

Wool Science is a Department within the School of Fibre Science and Technology.

9.001 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.

9.002 Seminar **F T1**

Seminars deal with research and/or development work being undertaken or recently completed by members of the Department of Wool Science, other University schools and research organizations. There are also seminars on communication in wool and pastoral sciences and on problems facing rural industries.

9.101 Biology of Grazing Sheep and Cattle **F L2T4**

The biology of wool growth and fibre structure; production and use of pastures; principles of the nutrition of grazing ruminants; the biology of reproduction of sheep and cattle.

Field excursions and laboratory work are integral parts of the course.

9.111 Livestock Production 1 **F L2**

Prerequisite: 9.101.

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 the one week's duration is held in Session 1.

9.112 Livestock Production 2 **S1 L2T1**

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.

9.113 Livestock Production 3 **F L1T2**

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.

9.131 Animal Health 1 **S2 L2T1**

Prerequisite: 9.111.

Managerial prevention and control of grazing livestock health, the animal species involved, the concept of economic approach to animal health. Introductory immunology. Skin health; sheep and cattle. Control of external parasites, particularly by insecticides. Reproductive health; sheep and cattle. Internal parasites; flukes, cysticercosis and tapeworms, nemotodes. Legal and Public Health responsibilities; Acts of Parliament relating to animal health.

9.132 Animal Health 2 **S1 L2T1**

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.

9.201 Agronomy **F L2T1**

Prerequisite: 9.101.

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.

9.202 Pastoral Agronomy **F L2T1**

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.

9.203 Crop Agronomy **S2 L2T1**

Prerequisite: 9.201.

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

9.204 Range Management **S2 L1T2**

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-term trends in productivity. Applications of remote sensing and ground truth sampling. Wild life resources and feral animals and their management. Sheep and beef cattle production in arid and semi-arid environments. Administration of rangelands (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.

9.301 Agricultural Economics and Management 1 **F L2T1**

The subject covers two broad strands: basic economic principles, and applied methods for farm management planning. The material on economic principles centres on **1.** the theory of production economics, which provides the background for many of the tools of applied farm management; and **2.** price theory with emphasis on agricultural markets.

The management planning strand emphasizes basic farm planning procedures such as partial, whole-farm and parametric budgeting, and gross margins analysis. As necessary background for the application of such methods, the course also includes coverage of valuation principles, land tenure, systems of title, discounting procedures, depreciation methods, tax and credit structures, and discussion of the design and use of farm record systems.

9.302 Agricultural Economics and Management 2 **F L2T1**

Prerequisite: 9.301.

Analysis of agricultural policies: agricultural marketing concepts; and an introduction to international trade theory. Investment appraisal and cost-benefit analysis.

Quantitative methods in agricultural economics and farm management with emphasis on **1.** response surface estimation and analysis; **2.** linear programming methods, with an introduction to other mathematical programming methods; **3.** systems analysis and simulation methods.

9.421 Animal Nutrition **S2 L3T1**

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.

9.501 Wool Science 1 **F L3T3**

Prerequisite: 9.101.

Raw materials and fibre identification; yarn manufacture; fabric manufacture; dyeing and finishing; testing and quality control. Wool biology; wool growth; wool fibre properties. Physical fleece characteristics; clip preparation; fleece defects; wool marketing procedures.

9.502 Wool Science 2 **F L1T2**

Prerequisite: 9.501.

The effect of clip preparation on textile processing; wool metrology (raw wool); distribution of fibre parameters.

9.503 Wool Science 3 **F L2T2**

Co- or prerequisite: 9.502.

Evaluation and typing; organizational structure of the wool industry. Marketing schemes; commercial (reserve price; AWC marketing plan); technical (traditional, sale by sample, sale by separation, sale by description). Wool metrology, advanced appraisal and evaluation; current wool outlook; research developments.

9.510 Natural Fibre Production **S2 L3T3**

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.

9.601 Animal Physiology 1 **S2 L2T2**

Prerequisite: 17.041.

Physiological 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.

9.801 Genetics 1 **S1 L2 S2 L2T1**

Prerequisite: 9.111.

Applied genetics in relation to sheep and other farm livestock. Mendelian inheritance. Chromosomes, linkage and the physical basis of heredity. Gene action in physiology, development and sex determination. Mutation. Principles of statistical genetics, strength of inheritance, selection, interrelationships, genetics and livestock improvement.

9.802 Genetics 2 **F L2T2**

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.

9.811 Biostatistics 1 **S1 L2T2**

Prerequisite: 45.101.

Experimental design to reduce experimental error. Factorial experiments. Fixed, mixed and random models. Response surface methods. Fractional replication. Confounding. Elements of multivariate analysis.

9.812 Biostatistics 2 **S2 L2T2**

Prerequisite: 9.811.

Least squares methods. Application to multiple regression. Application to experimental design models. Analysis of non-orthogonal data. Analysis to covariance. Non-linear regression.

9.901 Rural Extension **F L2T2**

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.

Mathematics

10.001 Mathematics 1 **F L4T2**

Prerequisite:

	HSC Exam Percentile Range Required
2 unit Mathematics or*	*71-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100*
or	
10.021B.	

Excluded: 10.011, 10.021B, 10.021C.

*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).

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

10.011 Higher Mathematics 1 **F L4T2**

Prerequisite:

	HSC Exam Percentile Range Required
3 unit Mathematics	*71-100*
or	
4 unit Mathematics	*11-100*

Excluded: 10.001, 10.021B, 10.021C.

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

10.021B General Mathematics 1B **S1 L4T2**

Prerequisite:

	HSC Exam Percentile Range Required
2 unit Mathematics or*	*51-100*
3 unit Mathematics or	*11-100*
4 unit Mathematics	*1-100*
or	
10.021A.	

Excluded: 10.011, 10.001.

*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).

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.

10.021C General Mathematics 1C **S2 L4T2**

Prerequisite: 10.021B. Excluded: 10.001, 10.011.

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.

10.022 Engineering Mathematics 2 **F L2T2**

Prerequisite: 10.001.

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; introduction to numerical methods; matrices and their application to theory of linear equations, eigenvalues and their numerical evaluation; vector algebra and solid geometry; multiple integrals; introduction to vector field theory.

10.031 Mathematics **F L1T1**

Prerequisite: 10.001 or 10.011 or 10.021C (CR).

Note A: A unit, together with 10.032, 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 and/or Theoretical Mechanics except that 10.412A may be taken with 10.031 and 10.032.

Note B: Mathematics 10.031 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, 10.031 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.

10.032 Mathematics **F L1T1**

Prerequisite: 10.031.

Note A: As for Note A in 10.031 Mathematics.

Note B: Mathematics 10.032 is included for students desiring to attempt only one Level III Mathematics unit. If other Level III units in Pure Mathematics, Applied Mathematics or Theoretical Mechanics are taken, 10.032 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.

10.1113 Pure Mathematics 2 — Multivariable Calculus **S1 or S2 L1½T1**

Prerequisite: 10.001 or 10.011. Excluded: 10.1213.

Multiple integrals, partial differentiation. Analysis of real valued functions of one and several variables.

10.2111 Applied Mathematics 2 — Vector Calculus **S1 or S2 L1½T½**

Prerequisite: 10.001. Excluded: 10.2211.

Properties of vectors and vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss' and Stokes' theorems. Curvilinear co-ordinates.

10.2112 Applied Mathematics 2 — Mathematical Methods for Differential Equations **S1 or S2 L1½T½**

Prerequisite: 10.001. Excluded: 10.2212.

Mathematical methods for ordinary and partial differential equations. Series solutions, numerical methods, separation of variables. Fourier series. Besser functions.

10.301 Statistics SA **F L1½T½**

Prerequisite: 10.001 or 10.021C. Excluded: 10.331, 10.311A, 10.311B, 10.321A, 10.321B, 45.101.

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.

Textile Technology

Textile Technology is a Department within the School of Fibre Science and Technology.

13.111 Textile Technology 1 **F L3T5**

Testing: Principles and practice of sampling textile materials. Statistical techniques. Physical testing of fibres and yarns. *Yarn Manufacture:* Principles of manufacture of yarns from staple fibres. *Fabric Manufacture:* Principles of weaving. The mechanics of shedding, picking and beating up. Secondary and auxiliary mechanisms of looms. Basic cloth structure and weave representation. Principles of knitting. Techniques of loop formation in warp and weft knitting. Basic knitted structures.

13.112 Textile Technology 2 **F L5T7**

Prerequisite: 13.111.

Part A. Testing: Physical testing of fabrics. Evaluation of the serviceability of textile fabrics. Qualitative and quantitative assessment of damage in textile materials. *Part B. Yarn Manufacture:* Manufacture of man-made fibre yarns: staple conversion, throwing, texturing. The traditional manufacturing systems: cotton, worsted, woollen. Special procedures for processing other fibres such as mohair, silk, flax, etc. *Part C. Fabric Manufacture:* Elements of woven fabric design. Derivative woven structures. Extra threads, compound cloths, woven pile fabrics, leno weaving. Elements of knitted fabric design. Derivative knitted structures. Techniques of needle selection in weft knitting. Raschel knitting. *Part D. Dyeing and Finishing:* General descriptions of properties of dyes, dyeing assistants, solvents used in dyeing, water supplies and water treatment, machinery used in dyeing, classification and methods of application of dyes, textile printing methods. Objects of finishing and typical flow diagrams, the principles underlying and the technology of processes concerned with: the removal of impurities and discoloration; the improvement and elimination of deficiencies in properties of textile fibres.

13.113 Textile Technology 3 **F L4½T3**

Prerequisite: 13.112.

Part A. Testing and Yarn Manufacture: Functions of quality control. The organization and integration of a quality control department in a textile factory. Fault investigation. Recent developments and trends in industrial textile testing methods. Recent research and development in yarn manufacture. *Part B. Fabric Manufacture:* The mechanics of woven fabric formation. Pirnless weaving, narrow fabric weaving, multi-phase weaving. Woven fabric geometry. The mechanics of loop formation in knitting. Hosiery manufacture, knitted pile fabrics, shaped knitted structures. Knitted fabric geometry. Tufting, stitch-bonding, non-woven fabrics. Techniques of garment manufacture, the mechanics of sewing. Analysis of the Australian textile industry. *Part C. Dyeing and Finishing:* The production of specified dimensions in textile fabrics. The development of specific properties: mechanical, surface finishes, protective finishes.

13.211 Textile Science 1 **F L2T1**

Production, properties and uses of textile fibres. Fibres, rubbers and plastics. Addition and condensation polymerization. Chemical constitution and reactivity of the natural and man-made fibres. Optical microscopy and birefrigence of fibres. Electron microscopy, X-ray diffraction and infra-red absorption. Molecular and morphological structure of fibres, crystallinity and orientation of polymers. First and second order phase transitions. Relationships between molecular structure and mechanical properties of fibres.

13.212 Textile Science 2 **F L2**

Prerequisite: 13.211.

Adhesion theory of friction, differential friction effects of wool, friction in textile processing. Static electrification of textile materials. Yarn structure, idealized helical yarn geometry, fibre migration, mechanics of twisted continuous filament and staple yarns. Structure of plied and blended yarns. Molecular interactions in fibres, elastomeric theory, viscoelasticity, spring and dashpot models. Eyring's theory of rate processes. Physical properties of macromolecular structures. Sorption in fibres. Polymerization kinetics, molecular weights of polymers, copolymers. Properties of surfactant solutions, micelle formation, surfactants as emulsifiers and detergents, detergency.

13.213 Textile Science 3 **F L2T2**

Prerequisite: 13.212.

Mechanical properties and rheological behaviour of fibres and fibre assemblies. Physical properties of textile materials including water adsorption, electrical properties, heat and moisture transfer. Comfort of clothing. Thermal insulation properties. Geometry of woven, knitted and non-woven fabric structures. Composite materials. Aspects of colour, colour mixing and colour vision. Introduction to adsorptiometry, spectrophotometry and tristimulus colorimetry. Measurement and specification of colour. Applications of colour measurement.

13.223 Advanced Textile Chemistry **F L2**

Co-requisite: 13.213.

Chemistry of amino acids and proteins. Photochemistry of fibres and dyes. Physical-chemical concepts of dyeing.

13.233 Advanced Textile Physics **F L2**

Co-requisite: 13.213.

1. General analysis of textile structures. Flexure and torsion of a twisted yarn. Flexure and shear properties of fabrics. Mechanisms of fabric deformation. **2.** One of: 1.1533 Biophysical Techniques, 1.3033 Mechanical Properties of Materials, 1.3133 Physics of Solid State Devices.

13.311 Textile Engineering 1 **F L1**

Mill illumination. Elements of strength of materials — tension, compression, shear, torsion and bending. Dynamics of rotary motion and mechanical power transmission. Industrial electricity.

13.312 Textile Engineering 2 **F L1½**

Prerequisite: 13.311.

Fluid flow. Applied heat, steam, air and heat transfer, air conditioning. Elements of automatic control. Introduction to Methods Engineering.

13.313 Advanced Textile Engineering **F L2**

Co-requisite: 13.312.

1. Same as **1.** in 13. 233 Textile Physics. **2.** Heat and mass transfer. Conveying of gases, fluids and solids.

13.411 Project **F T7**

Students are required to carry out a research project and to submit a thesis describing the results of their investigations. It is usual for students to be allocated projects in areas related to the particular course strand they are studying. The following examples are typical. *Textile Chemistry:* Topics related to the dyeing and finishing of textiles and to the chemistry of fibres. *Textile Engineering:* Engineering design work, some engineering aspect of textile processes, or some other topic of an engineering nature. *Textile Manufacture:* A topic related to textile processing or a topic of a commercial nature, such as some aspect of marketing, management or economic planning as applied to the textile industry. *Textile Physics:* The application of some aspects of physics to textile processing or to fibre, yarn or fabric structure and properties.

13.511 Seminar **S1T1**

Students prepare and present a seminar before an audience consisting of staff of the School, final year students and other interested undergraduate and graduate students, on a subject of topical and specific interest in the field of textile science, technology or commerce, and subsequently submit it in writing.

13.710 Fibre Science **S1 L3T3**

Description of necessary and desirable attributes of textile fibres; introduction to production of natural and man-made fibres: physics and chemistry of natural and man-made fibres; physical testing of fibres and fibre assemblies.

Accountancy

14.501 Accounting and Financial Management 1A — S1 or S2 L2T2½

Prerequisite: Nil.

The basic concepts of financial model building and information systems, including the double-entry recording system, the accounting cycle, income measurement and financial reporting, and an introduction to basic elements of auditing.

14.511 Accounting and Financial Management 1B — S1 or S2 L2T2½

Prerequisite: 14.501.

Development of basic concepts introduced in 14.501 Accounting and Financial Management 1A, including corporate reporting, business finance, system design, elementary computer applications.

Economics

15.001 Microeconomics 1 — S1 or S2 L2T1½

Commerce/Arts/Applied Science/Sciences prerequisite:

	HSC minimum mark required
2 unit English (General) or	*60*
2 unit English or	*53*
3 unit English	*1*

Economics as a social science, the central role of scarcity and opportunity cost. Australian industrial structure. Efficiency concepts. Relative prices and their change through time. Demand, revenue and elasticity. Theory of exchange. Property rights, externalities and distortions. Gains from specialization and international trade. Marginal productivity, input demand. The price taking firm, profit maximization in short and long run. Taxation, protection, stabilization of markets. Imperfect markets, competition policy. Investment decisions and economic growth.

15.002 Microeconomics 2 — S1 L2T2

Commerce prerequisite: 15.011.

Applied Science/Sciences prerequisites: 15.011 plus 15.401 or 15.411 or 10.001 or 10.011.

Arts prerequisite: 15.011. Co-requisites: 15.401 or 15.411 or 10.001 or 10.011.

Excluded: 15.012, 15.072.

Consumer behaviour. Theory of the firm, production theory. Competition, monopoly, oligopoly. Factor markets. General equilibrium analysis: efficiency and equity, welfare maximisation, gains from trade. Externalities, market distortions. Intertemporal economics, investment criteria.

15.003 Macroeconomics 3 — S2 L2T2

Commerce prerequisite: 15.042 or 15.052.
Arts/Applied Science/Sciences prerequisite: 15.042 or 15.052. Co-requisite: 15.412.
Excluded: 15.013.

Macroeconomic theory and policy including an introduction to the theory of economic policy, the structure and dynamic characteristics of macro-models, fiscal policy, monetary theory and policy, inflation and unemployment. Rational expectations. Macroeconomic policy in Australia.

15.011 Macroeconomics 1 — S1 or S2 L2T1½

Commerce/Arts/Applied Science/Sciences prerequisite: 15.001.

The economics of output, employment and inflation, including social accounting, consumption and investment functions, the Keynesian goods market model, supply and demand for money, interactions between the goods and money markets in equilibrium and disequilibrium situations, inflation and the balance of payments.

15.042 Macroeconomics 2 — S2 L2T2

Commerce prerequisite: 15.011.

Arts/Applied Science/Sciences prerequisites: 15.002 plus 15.401 or 15.411 or 10.001 or 10.011. Co-requisite 15.421.
Excluded: 15.052, 15.062.

Extensions to the Keynesian model of income determination. Consumption and investment theories. Money demand and supply. Balance of payments and exchange rate analysis. Inflation and unemployment. Introduction to dynamic analysis. Labour markets. Growth and cycles.

15.043 Marxian Political Economy — S1 L2T1

Commerce/Arts/Applied Science prerequisite: 15.011.

Varieties of political economy, Marx and the classics, the Marxian system, Marxian economics since Marx, Marx and socialist planning, Marxian analysis of current economic problems.

15.053 Economics of Developing Countries — S1 L2T1

Commerce/Arts/Applied Science prerequisite: 15.072 or 15.103 or 15.113.

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 strategies of development based on industry or agriculture.

15.062 Applied Macroeconomics — S1 or S2 L2T1½

Commerce/Arts/Applied Science/Sciences prerequisite: 15.011.
Excluded: 15.052 and 15.042.

Economic growth and fluctuations in Australia. Inflation, unemployment and balance of payments issues. Fiscal, monetary, exchange rate and incomes policies. Changes in the structure of the Australian financial system and its links with the international monetary system. Effects of restrictions on capital markets.

15.072 Applied Microeconomics **S1 or S2 L2T1½**

Commerce/Arts/Applied Science/Sciences prerequisite: 15.011. Excluded: 15.012 and 15.002.

Structural change in the Australian economy. The effect of different market structures on firms and consumer welfare. The consequences of markets 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.

15.073 Natural and Environmental Resources Economics **S1 or S2 L2T1**

Commerce/Arts/Applied Science/Sciences prerequisite: 15.002 or 15.012 or 15.072.

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.

15.083 Public Finance **S1 or S2 L2T1**

Commerce/Applied Science prerequisite: 15.002 or 15.012 or 15.072. Arts prerequisites: 15.002 or 15.012 or 15.072 plus 15.421 or 15.403.

General aspects of public sector expenditure and its financing with special reference to Australia: role of government in the economy; principles and types of public expenditure; tax sharing and revenue systems; economic and welfare aspects of different types of taxes and social service systems; inflation and tax indexation; loan finance and the public debt; fiscal policy, the Budget and the economy.

15.093 Public Sector Economics **S1 or S2 L2T1**

Commerce/Arts prerequisite: 15.002 or 15.012 or 15.072. Applied Science prerequisite: 15.002 or 15.012 or 15.072 with the approval of the Head of the Department of Economics.

The theory of public economic activity in the short-run and the long-run. Government objectives and the social welfare function. Equity and efficiency in revenue raising. 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.

15.143 Microeconomics 3 **S1 L2T2**

Commerce prerequisite: 15.002 or 15.012. Arts/Applied Science/Sciences prerequisite: 15.002 or 15.012. Co-requisite: 15.412. Excluded: 15.153.

Input-output analysis, applications to Australia. General equilibrium analysis: industry protection and taxation. Income distribution. Market failure, property rights and public goods. Introduction to analysis of uncertainty. Deregulation of industry. Public enterprise pricing and investment.

15.163 Industry Economics and Australian Industrial Policy **S1 L2T1**

Commerce/Applied Science prerequisite: 15.002 or 15.012 or 15.072. Arts prerequisites: 15.403 or 15.421 plus 15.072 or 15.012 or 15.002.

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).

15.212 Managerial Economics **S1 L2T1½**

Prerequisites: 15.001 and 15.011.

Not offered in 1987.

The application of economic concepts and analysis to managerial decision making. The relevance of opportunity cost and marginal analysis. Introduction to linear programming as a tool for managerial decision making. Production and cost analysis and measurement, with applied examples. Market and demand analysis and forecasting with applied examples. Problems of price setting. The role of non-price competition, such as advertising. The cost of capital and capital budgeting. An introduction to risk.

Biological Sciences

Students must pay the laboratory fee and then use the receipt to obtain a 'course guide' during Orientation Week from the First Year Science Registration Centre, School of Physics Building.

17.031 Biology A **S1 L2T4**

Prerequisite:

	HSC Exam Percentile Range Required
2 unit Science (Physics) or	*31-100*
2 unit Science (Chemistry) or	*31-100*
2 unit Science (Geology) or	*31-100*
2 unit Science (Biology) or	*31-100*
4 unit Science (multistrand)	*31-100*

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.

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.

17.041 Biology B **S2 L2T4**

Prerequisite: 17.031. Excluded: 17.021.

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.

Industrial Engineering

Industrial Engineering is a Department within the School of Mechanical and Industrial Engineering.

Undergraduate Study

18.121 Production Management **F L2T1**

Prerequisites: 10.031, 10.331.

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 organizations, 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 optimization of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queueing theory, inventory models, simulation.

18.1211 Production Management A **S1 L3**

Prerequisites: 10.031, 10.331.

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, interrelationships and information flow. Sampling techniques in quality control, control charts. *Introduction to Inventory Control*: Analysis of some engineering planning decisions.

18.131 Operations Research

Introduction to Operational Research: The formation and optimization of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, eg mathematical programming, queueing theory, inventory models, simulation.

18.551 Operations Research **F L2T1**

Prerequisites: 18.603 or 18.121, 5.0721, 10.351. Excluded: 6.646.

The formulating and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queueing 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.

Centre for Petroleum Engineering

20.301 Properties and Phase Behaviour of Petroleum Reservoir Fluids **S1 L3**

Chemical, physical and thermodynamic properties of petroleum and reservoir fluids. Phase behaviour of multicomponent hydrocarbon systems. Use of computers to predict complex phase behaviour, real gas law, liquid mixtures, flash calculations, pressure, volume and temperature calculations for reservoir fluids. Application of these concepts to the prediction of gas and gas-condensate reservoir behaviour.

20.302 Reservoir Rock Properties and Fundamentals of Fluid Flow in Porous Media **S1 L3**

Structure, properties and fluid content of reservoir rocks. Darcy's Law and the concept of permeability for single and multiple flow. Capillary phenomena and static distribution of fluids. Calculation of hydrocarbon volume in place. Elementary flow processes in reservoirs.

20.303 Well Drilling and Completions **S2 L3**

Well drilling methods and elements of rock mechanics. Rheology of Newtonian and non-Newtonian fluids, chemical properties and carrying capacity of drilling fluids, rotary drilling hydraulics, bit hydraulics and factors affecting rate of penetration. Prediction and control of abnormal pressures. Casing and tubing design, principles of cementing, well completion materials, well perforating, equipment and operative standards, acidizing, fracturing, problem well analysis and remedial treatment design.

20.304 Reservoir Engineering I **S2 L3**

Prerequisite: 20.301, 20.302.

Classification of reservoirs by type and recovery mechanism, reserve and production rate estimates based on material balance calculations. Introduction to displacement processes in petroleum reservoirs. Design of reservoir development.

20.305 Drilling and Production Lab **S2 L3**

Prerequisite: 20.301, 20.302. Co-requisite: 20.303.

Properties of drilling fluids. The design, composition and measurement of the properties of drilling fluids. Measurement of basic rock properties such as porosity, permeability and capillary pressure.

20.306 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.

20.307 Petroleum Thermodynamics **S1 L2T1**

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.

20.401 Reservoir Engineering II **S1 L3**

Prerequisite: 20.304.

Basic unsteady-state flow for single phase fluids in porous media. Diffusivity equation and solutions. Application to practical well test analysis methods. Pressure build-up, drawndown, interference and pulse testing to evaluate reservoir properties. Extension to multiphase flows and introduction to displacement processes in petroleum reservoirs.

20.402 Reservoir Fluids Laboratory **S1 L3**

Prerequisite: 20.301.

Physical properties of petroleum and its products, gravity, viscosity, surface tension, chromatography. PVT analysis of reservoir fluids.

20.403 Production Engineering **S1 L3**

Prerequisite: 20.304.

Analysis, specification and characteristics of production systems. Well inflow performance. Single and multiphase flow in vertical pipes. Methods and design of artificial lift systems. Surface separation, fluid transmission and processing.

20.404 Formation Evaluation **S1 L3 S2 L3**

Prerequisite: 20.301, 20.302.

Principles of well logging methods and relationships between measured properties and reservoir properties. Interpretation and analysis of log suites for reservoir analysis and completion design. The use of computers in log analysis and interpretation. A course of lectures and practical problem solving.

20.405 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.

20.406 Reservoir Simulation Fundamentals **S2 L3**

Prerequisite: 20.401, 10.032, 48.032.

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.

20.407 Advanced Recovery Mechanisms **S2 L3**

Prerequisite: 48.041, 20,401.

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.

20.408 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.

20.409 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.

20.410 Well Pressure Testing **S1 L2**

Theory of transient well testing. Practical aspects of design and performance of field tests. Analysis of transient 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.

Applied Geology

Applied Geology is a Department within the School of Mines.

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.

25.110 Earth Materials and Processes — S1 L2T4

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. *Earth 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.

25.120 Earth Environments and Dynamics — S2 L2T4

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics or*	*71-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100*
and	
2 unit Science (Physics) or	*31-100*
2 unit Science (Chemistry) or	*31-100*
4 unit Science (multistrand)	*31-100*
and	
25.110.	

*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).

Earth 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. *Earth 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.

25.211 Earth Materials 1 — S1 L2T4

Prerequisite: 25.120.

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 crystallization and differentiation. Partial melting. Simple binary melting diagrams. Igneous petrology 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.

25.212 Earth Environments 1 — S1 L3T3

Prerequisite: 25.120.

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, Brachiopoda, Mollusca, Arthropoda, Protochordata and Echinodermata. Introductory palaeobotany. Palaeoecology. 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.

25.221 Earth Materials 2 — S2 L3T3

Prerequisite: 25.211.

Sedimentary Petrology: The influence of transportation, deposition and diagenesis on the composition, texture and structure of detrital sedimentary rocks. The non-clastic sedimentary rocks including phosphates, evaporites, ferruginous and silceous deposits. *Metamorphic Petrology:* Origin and classification of metamorphic rocks as an aid in understanding common mineral assemblages. Petrographic studies of common metamorphic rocks. Field studies. *Structural Geology:* Origin, classification and description of structures in rocks. Techniques of stereographic projection of structural elements and analysis of simple fracture systems. Tectonics and tectonic analysis. *Field work* of up to four days is a compulsory part of the subject.

25.223 Earth Physics — S2 L2T4

Prerequisite: 25.110.

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.

25.2261 Mathematical Geology 1 **S2 L2T1**

Prerequisite: 25.120.

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; text editing; control language for VAX and CYBER.

25.311 Earth Materials 3 **S1 L2T4**

Prerequisite: 25.221.

Mineralogy: Principles of X-ray powder diffractometry and the use of X-ray powder cameras and diffractometers. Elementary stereology. Laboratory methods of mineral separation. 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.

25.312 Earth Environments 2 **S1 L3T3**

Prerequisite: 25.212 (note: it is desirable that students taking this unit have also taken 25.223).

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 Palaeozoic 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 biological classification. Processes and theories of evolution. The origin and early history of life. Functional morphology. Practical application of palaeontology. *Field Mapping:* Geological mapping in a complicated geological terrain. Geological report writing and cartography. *Field work* of up to seven days is a compulsory part of the subject.

25.314 Mineral and Energy Resources 1 **S1 L3T3**

Co-requisite: 25.221 or 25.311.

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

25.3162 Mathematical Geology 2 **S1 L2T1**

Prerequisite: 25.2261.

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.

25.321 Earth Materials 4 **S2 L3T3**

Prerequisite: 25.221.

Clay Mineralogy: The structure and properties of the clay mineral groups including the kaolinites, illites, smectites, chlorites, mixed layered and fibrous clay minerals. Techniques for the identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. Industrial uses of clays and bauxite. *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 metamorphism. Fabric. Relationships of deformation 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.

25.324 Mineral and Energy Resources 2 **S2 L3T3**

Prerequisite: 25.212 or 25.5212.

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:* Occurrence 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 sedimentation 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.

25.325 Engineering and Environmental Geology **S2 L4T2**

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 law 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 practices. Measurements of grain size, grain shape and packing; analyses of measured data. Geological significance of sediment parameters. The shoreline processes Littoral and longshore drifts and net sand movement. Coastal engineering works. The estuarine environment. *Field work* of up to three days is a compulsory part of the subject.

25.3261 Geochemical Analytical Techniques **S2 L1T1**

Prerequisite: 25.311.

Sampling and sample preparation. Modern destructive methods of rock and mineral analysis. Non-destructive methods; X-ray fluorescence spectroscopy and electron probe microanalysers.

25.3271 Structural Geology **S2 L1T1**

Prerequisite: 25.221.

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.

25.333 Exploration Geophysics **S1 L3 and S2 L1T1**

Prerequisite: 25.120.

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.

25.410 Resource Geology **S1 L3T6**

Exploration Geochemistry: Principles and techniques of soil, drainage and rock geochemistry as applied to mineral exploration. *Mathematical Geology:* 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. *Remote Sensing:* Principles of various remote sensing techniques including landsat and side-looking airborne radar. The 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. *Precambrian Geology:* Distribution, terminology, concepts, general features of the Archaean and Proterozoic. Archaean of Australia: Pilbara, Yilgarn. Proterozoic of Australia: Kimberleys, Broken Hill. Precambrian syntheses: tectonic, plate tectonics. Aspects of Precambrian mineralization. *Resource Economics:* Introduction to the role of earth resources in industrial society; availability of resources and consideration of grade, price, economic, technical and political factors. Distribution, production, consumption and trade in minerals. Supply adequacy and resource assessment. Review of Australian and New South Wales mineral industry. Economics of engineering geological works. *Report Writing:* Techniques of scientific report writing, especially preparation of theses and research articles. Methods of illustrating verbal and written presentations. Guidelines to verbal presentations. *Field work* of up to seven days is a compulsory part of the subject.

25.4101 Topics in Advanced Geology **S1 L3**

Topics in geology selected from a list of subjects available from the Head of Department.

25.4121 Advanced Sedimentology **S1 T6**

Detailed field and laboratory study of sedimentary textural and structural characteristics of a sedimentary sequence and determination therefrom of its palaeogeographic setting.

25.4122 Seismic Stratigraphy and Log Analysis **S1 L1T1**

Structural and stratigraphic interpretation of seismic records at both regional and prospect scales. The application of wire-line logs to stratigraphic analysis and formation evaluation and the integration of log and seismic data in sedimentary basin analysis.

25.4123 Geology of Selected Oil and Gas or Coal Fields **S1 L1T1**

Literature study and seminars on typical Australian and, in particular, overseas productive regions and fields.

25.4124 Palynology or Foraminiferal Micropalaeontology **S1 L1T1**

Laboratory based studies in the application of palynology to geological problems; *or*, use of foraminifera in dating, correlation and stratigraphical subdivision; also diagnostic techniques as applied to principle zonal species.

25.4141 Mineral Exploration **S1 L1½ T1**

The use of geology in mineral exploration and area selection involving the development of conceptual models, the organization of exploration programs, radiometric methods, exploration ground tenure in New South Wales and exploration drilling.

25.4142 Geological Sampling and Analytical Methods **S1 L1T1**

Methods of collection of samples in exploration geochemistry including waters, soils, drainage sediments and rocks. Methods in estimating and monitoring sampling and analytical errors. Determination of selected elements in soil and stream samples by atomic absorption, fluorometric, specific ion electrode and colorimetric methods.

25.4143 Research Project **S1 L1T1½**

An integrated study involving literature review and laboratory analysis of an appropriate mineralized environment.

25.4151 Hydrogeology **S1 L1T2**

Hydrogeological systems analysis. Ground water mapping techniques. Ground water resources evaluation. Hydraulics of anisotropic aquifers.

25.4152 Engineering Geology **S1 L1T2**

Analysis of fractured systems for engineering purposes. Fabric analysis of engineering soils. Slope stability. Advanced geological surveying techniques.

25.4153 Environmental Geology **S1 L1T2**

Geological factors in waste disposal — domestic, industrial and radioactive. Environmental parameters of coasts and beaches.

25.4154 Engineering Project **S1 L1T3**

A field and laboratory project in an aspect of engineering geology.

25.420 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.

25.510 Geology for Geomorphologists and Pedologists **S2 L2T3**

Prerequisites: 25.211, 25.221, 25.212.

Clay Mineralogy: The structure and properties of the clay groups, including the kandites, illites, smectites, chlorites, mixed layered and fibrous clay minerals. Techniques for the identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. Industrial uses of clays and bauxite. *Sedimentology:* Properties of sedimentary populations. Sampling practices. Measurement of grain size, grain shape and packing; analyses of measured data. Geological significance of sediment parameters. *Coastal Geology:* The shoreline processes. Littoral and longshore drifts and net sand movement. Coastal engineering works. The estuarine environment: sedimentation, chemical and biological processes. Investigation techniques.

25.5112 Geology for Civil Engineers **S1 L2T1**

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

25.520 Geology for Mining Engineers 1 **F L1T1**

Outline of the main branches 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 and depositional environment, composition and classifaction. *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 including 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.

25.5212 Sedimentology **S1 L1T1**

Prerequisite: 25.120. Excluded: 25.212.

As for *Sedimentology* in 25.212 Earth Environments 1. Available only to Course 3145.

25.523 Mineralogy **F L1T1**

Crystallography, crystalline state and crystal growth of minerals. Fundamentals of the atomic structure of minerals, with examples of Bravais lattices and introduction to space lattice group theory. Physical properties of crystals; cleavage, gliding, secondary twinning, elasticity. Elements of crystal optics in polarized light. Classification, descriptive mineralogy and occurrence of primary and secondary minerals with special emphasis on economic metallic and non-metallic minerals. Introduction to petrology. Mode of formation of minerals and ores in the igneous, sedimentary and metamorphic cycles. Examples of principal types of economic mineral deposits, their mode of formation, parageneses, textures and intergrowths. Elements of fuel geology, construction and refractory materials. *Laboratory: Crystallography* — Examination of crystals and crystal models for symmetry. Stereographic projection of crystals. *Optical Mineralogy* — Examination of minerals and rocks in transmitted and incident light using the polarizing microscope. Determination of refractive indices of crystal fragments by the immersion method. *Descriptive and Determinative Mineralogy* — Macroscopic examination of common minerals with emphasis on economic minerals. Study of texture and intergrowths of common mineral parageneses including the principal rock types in which they occur.

25.530 Geology for Mining Engineers 2 **F L2T2**

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. *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.

25.5331 Physical Geology for Petroleum Engineers 1 **S1 L1T2**

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.

25.5332 Physical Geology for Petroleum Engineers 2 **S2 L1T2**

Sedimentary petrology, sedimentary environments and facies, facies analysis, orgins and formation of petroleum, exploration techniques, petroleum in Australia.

25.5302 Structural Geology for Petroleum Engineers **S2 L1 T2**

Prerequisite: 25.301.

Origin and properties of both regional and local geological structures and petroleum traps. Delineation of structures and petroleum traps by geoghysical methods.

25.5311 Aqueous Geochemistry **S1**

Prerequisite: 25.221.

As for *Aqueous Geochemistry* in 25.311 Earth Materials 3. Available only to Course 3145. Note: Tutorials comprise 10 hours total in Session 1 only.

25.5312 Geological Field Mapping **S1 L2**

Prerequisite: 25.5212. Excluded: 25.312.

As for *Field Mapping* in 25.312 Earth Environments 2. Available only to Course 3145.

25.5313 Stratigraphy **S1 L2**

Prerequisite: 25.5212. Excluded: 25.312.

As for *Stratigraphy,* in 25.312 Earth Environments 2.

25.542 Mining Geology Project **S2**

Note: Comprises 18 hours total in Session 2.

25.9311 Gravity and Magnetic Methods **S1 L2T1**

Prerequisites: 1.001 and 10.001. It is desirable that students taking this unit have a background in 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.

25.9312 Seismic Methods **S1 L2T1**

Prerequisites: 1.001 and 10.001. It is desirable that students taking this unit have a background in geology.

Seismic waves. Physical/engineering properties of geological materials. Ray theory in seismic refraction and reflection methods. Instrumentation. Data acquisition and processing. Depth and velocity analysis. Geophysical and geological interpretation. Case history studies. *Field work* of one day is a compulsory part of the subject.

25.9313 Electrical Methods **S1 L2T1**

Prerequisites: 1.001 and 10.001. 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.

25.9315 Regional Geophysics **S1 T15**

Qualitative and quantitative appraisal of geophysical data for a selected area.

Servicing Subjects

These are subjects taught within courses offered by other faculties.

For further information regarding the following subjects see the Combined Sciences Handbook.

25.412 Sedimentary Basin Resources

See Sedimentary Basin Resources strand in Applied Science Course 3000 Applied Geology Year 4. Available only to programs 2500, 5825.

25.414 Mineral Resources

See Mineral Resources strand in Applied Science Course 3000 Applied Geology Year 4. Available only to programs 2500, 5825.

25.415 Engineering and Environmental Geology

See Engineering and Environmental Geology strand in Applied Science Course 3000 Applied Geology Year 4. Available only to programs 2500, 5825.

25.434 Geology Honours (Single Major)

25.621 Marine Geology 1 **F L1T2**

Prerequisites: 25.601 or both 25.110 and 25.120.

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, geomagnetism, 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.

25.622 Hydrological and Coastal Surveying **F L1T2**

Prerequisites: Nil.

General principles of surveying, with particular reference to coastlines and off-shore techniques. Optical and electronic methods of distance measuring and position fixing. Methodology for short-term and long-term measurement of tides and flow currents. Bathymetric surveys in shallow and deep water conditions. Coastline morphologies and their relationship to the behaviour of water masses. Analysis of sedimentary systems in deltaic, estuarine and near-shore environments. Data collecting, processing and storage. Shallow-water investigations for bedrock morphologies. *Field work* of five days is a compulsory part of the subject.

25.631 Marine Geology 2 **F L1T2**

Prerequisite: 25.621.

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:* Technique 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 and structuring of basins in tensional, compressive and strike-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 sedimenty 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 exceeding two days is a compulsory part of the subject.

25.632 Estuarine Geology **F L1T2**

Prerequisite: Nil.

The physical nature of the estuarine environment; its characteristic topography, chemistry and layering of water masses; tidal behaviour. Characteristic sediments, stratigraphy of sediment bodies and distribution patterns of sediments and microfossils in estuaries. Inorganic and microbial diagenesis of estuarine sediments. Procedures for mapping, sampling and sample analysis. Mineral morphology. Statistical treatment of results. *Field work* of four days is a compulsory part of the subject.

25.6341 Marine Mineral Deposits and Oceanic Minerals **S1 L1T1**

Oceanic minerals and mineral deposits: detrital, authigenic and epigenetic. Methods of exploration, assessment and exploitation, international law relating to the sea floor. 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.

25.6342 Exploration and Seismic Methods **S2 L2T1**

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.

25.9314 Geological Applications **S1 L1T1**

Prerequisite: 25.120.

A subject of ten weeks' duration. *Structural Geology:* Elements of structural geology, stereographic projection and fracture analysis. *Geology of Fuels:* Origin of coal, oil and natural gas; stratigraphic and structural consideration of oil and coalfields. *Hydrogeology:* Principles of hydrogeology; transmission of groundwater in rocks and soils. *Field work* of one day is a compulsory part of the subject.

25.931 Geophysics

See Geophysics strand of Applied Science Course 3000 Applied Geology Year 4. Available only to programs 2500, 5825.

25.9321 Geophysical and Geological Applications **S2 L1T2**

Prerequisite: 25.120. Excluded: 25.6342.

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.

Geography

27.010 Land Studies **S1 L2T2**

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.

27.020 Locational Processes **S2 L2T2**

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.

27.030 Environmental Processes **S2 L2T2**

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, alternatives to and movement of materials.

27.040 Data Processing Systems **F T2**

Problems, methods and techniques in the measurement, processing and display of spatial data. Acquisition of 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.

27.050 Geographical Data Analysis **F L2T2**

Prerequisites: 27.111 or 27.010 and 27.030. Excluded: 27.162, 27.632, 27.813, 27.884.

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.

27.121 Pedology for Pastoral Sciences **½S1 or ½S2 L2T3**

Properties and types of soils, with emphasis on factors and processes controlling global and regional distribution, soil profiles and laboratory measurement of soil properties; principles of soil classification and mapping.

27.133 Pedology **S2 L2T3**

Prerequisites: 27.010 and 27.030 or 27.111 or any two units from 2.111, 2.121, 2.131, 2.141, and 27.811, 27.828 or 27.311 or 25.012 or 25.022.

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.

27.143 Biogeography **S1 L2T3**

Prerequisites: 27.010 and 27.030 or 27.811 or 27.828 or 17.031 and 17.041 or 27.111 or 27.172.

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 man 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. Composition, structure, productivity and environmental controls of heathland, woodland, grassland and rainforest communities. Management of vegetation in different climate regimes. *Field work* of up to five days is a compulsory part of the subject.

27.153 Climatology **S1 L2T3**

Prerequisites: 1.001 or 27.811 or 27.828 or 25.110 and 25.120 or 17.031 and 17.041 or 27.111.

Physical bases for understanding microclimate. Processes of energy exchange at the earth's surface, and the atmospheric and terrestrial surface controls of the heat and mass budgets. Atmospheric diffusion. Wind profiles and atmospheric turbulence as affected by stability and surface properties. Determinants of the local and site-specific climatic environment, particularly topographic, surface cover and substrate conditions. Urban climate and climate in relation to human comfort and health. Building and constructional design aspects of climate and applications of climatology in urban and regional planning. Climatic aspects of the development and regional planning. Climatic aspects of the development and utilization of solar and wind energy sources.

27.175 Introduction to Remote Sensing **S1 L2T2**

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.

27.176 Remote Sensing Applications **S2 L2T2**

Prerequisite: 27.175 or 27.1711.

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.

27.180 Field Project **S1 T4**

Professional skills in problem formulation, field work, data analysis, report preparation and report presentation. Selected problems of applied geographical analysis. An on-campus briefing session provides students with background on the region selected for fieldwork, and with and opportunity to define problems and plan a strategy for their investigations. *Field work* of five days is a compulsory part of this subject. (Both the briefing session and the field work are undertaken prior to the commencement of Session 1). During session, students develop a professional quality document recording their investigations and findings, and present a report on their study.

27.183 Geomorphology **S2 L2T3**

Prerequisites: 25.110 and 25.120 or 27.010 and 27.030 or 27.811 or 27.828 or 27.111 or 27.172. Excluded: 27.860.

Beaches and their response to waves, currents and sediment movement. Barrier systems, lagoons and estuaries. Rock platforms. Quaternary sea level changes. Hydraulic geometry of stream channels, including effects of sediment transport and humans' activities. Hillslope form, process and associated slope materials. Methods of slope measurement, analysis and survey. Hillslope models. Systems approach, equilibrium concepts and modelling in landform studies. Field projects in coastal and fluvial geomorphology, and laboratory time is devoted to statistical exercises using data collected from maps, airphotographs and in the field.

27.190 Assessment of Human and Physical Resources **S1 L4T4**

Assessments of human and physical resources and environments. Specialised study in two of 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.

27.193 Environmental Impact Assessment **S1 L2T1**

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 impact. 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.

27.432 Computer Mapping and Data Display **S1 L1T3**

Prerequisites: Successful completion of a Year 1 program in Applied Science, Science or Arts (or equivalent) as approved by Head of School.

Principles of graphic information processing. Introduction to thematic mapping and automated cartography; theoretical and practical problems in displaying and mapping data by computer. Review and application of computer mapping packages including SYMAP, SYMVU, CALFORM, GIMMS and SURFACE II.

27.500 Mathematical Methods for Spatial Analysis **S1 L2T2**

Prerequisite: 10.021B and 10.021C (or 10.001 or 10.011) and 27.040 or 27.641.

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; and use of heuristic procedures in facility location and allocation problems.

27.504 Projects **S1 T10 and S2 T16**

Biogeography or Bioclimatology: study of the vegetation in an area, and detailed consideration of a problem arising from this survey, preferably with an applied aspect, or a study of the climate of some well defined plant or animal habitat as related to characteristics of the vegetative cover and substrate. *Economic Geography:* a problem in applied economic geography involving experimental design, the acquisition and manipulation of field data and the presentation of a report. *Geomorphology or pedology:* an area study introducing soils-landscape relationships in a dynamic or chronologic sense; or a systematic study which may be primarily geomorphic or pedologic, but with some interdisciplinary aspect. To include a field element and a supporting laboratory program.

27.510 Project in Spatial Analysis **S2 L1T3**

Prerequisite: 27.500.

Supervized 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.

27.514 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.

27.520 Regional Theory **S1 L2T2**

Prerequisite: 27.020 or 27.611.

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.

27.613 Applied Economic Geography 3A **S1 L2T3**

Selected topics in applied economic geography with particular reference to urban and regional analysis and planning.

27.623 Applied Economic Geography 3B **S2 L2T3**

Selected topics in applied economic geography with particular reference to the spatial implications of economic, social and technological change.

27.633 Geographic Data Analysis 3 **F L2T4**

Principles of research design; field survey methods; numerical taxonomy; non-metric measurement techniques; multivariate methods, introduction to additional computer software. Student projects and development of Year 4 thesis topics.

27.652 Geographic Information Systems **S2 L2T2**

Prerequisites: 10.021B and 10.021C, or 10.001 or 10.011 or 27.432.

An introduction to information systems of particular relevance for economic geography with special reference to computer-based systems for resource evaluation. Problems of data structures, geocoding, and spatial identifiers. Model-based information systems. Project work: case study evaluation and the development of information systems for monitoring spatial change.

27.662 Urban Systems **S1 L2T1**

Not offered in 1987.

The nature of urban systems and urban problems, the extent of urbanization and the links between urban functions and the dimensions of urban systems. Focus on specific theories of the internal structure of cities and associated urban problems. Topics include land-use structure, urban sprawl, speculation, population density models, segregation, slums, urban commercial structure, accessibility, transport and congestion, and welfare issues relating to optimal cities and equity within urban areas.

27.672 Transport and Land Use **S1 L2T2**

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. Simple transport-land use models, introduced in laboratory classes.

27.713 Marketing Geography **S2 L2T3**

Prerequisite: 28.042. Note: This prerequisite does not necessarily apply to students enrolled in the Faculty of Applied Science.

Spatial reality as a result of consumer and producer decisions. The relationship between consumer spatial behaviour and the pattern and structure of marketing establishments. Organization and operation of the marketing function with emphasis upon the pattern of consumer orientated enterprises and the structure of market areas in intra-urban areas. Spatial behaviour of consumers including search and decision processes. Workshop seminars on analytical techniques and issues raised in lectures.

27.723 Transport Geography **S2 L2T3**

Offered subject to availability of staff.

The analysis of the transportation system in terms of its relationship with economic and geographical indicators. Focus is on network analysis, trip generation models, freight movement, transport impact studies and the transport energy problem. Lectures are accompanied by seminars which stress the consideration of major problem areas in transportation in Australia.

27.733 Regional Policy and Planning **S2 L2T3**

Offered subject to availability of staff.

Regional forecasting and techniques for evaluating regional plans are emphasized. Topics include: regional information systems and budgets; exploratory and normative forecasting methods; time series projections; integrated forecasting models; cost-benefit analysis; planning balance sheets, goals — achievement matrix methods of evaluation; reviews of plans and programs for regional development in Australia. Lectures are accompanied by workshop sessions which concentrate on methodology.

27.743 Regional Population Analysis **S1 L2T3**

Offered subject to availability of staff.

The primary emphasis is on regional population estimation and forecasting with reference to Australian conditions and the use of Australian data. The secondary emphasis is estimation for regions in adjacent Third World countries. The population forecasting is handled within the framework of demographic theory and component analysis; migration analysis is given particular attention because of the importance of mobility in Australia. The derivation of regional and local social indicators in the context of population change and service provision in Australia.

27.753 Social Welfare and Urban Development **S2 L2T3**

Prerequisite: 27.829 or 27.812. Note: This prerequisite does not necessarily apply to students enrolled in the Faculty of Applied Science.

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.

27.783 Spatial Impacts and Opportunities **S1 L2T3**

Offered subject to availability of staff.

Selected problems in the location of public services and measurement of spatial opportunity; methods for assessing the local and regional effects of new facilities; multiplier models; and socio-economic impact studies, and spatial implications of technological change.

27.793 Models of Spatial Systems **S2 L2T3**

Offered subject to availability of staff.

The design and development of models of spatial systems, including: entropy maximization methods; control theory; evaluation of alternative models; and case studies of models in urban and regional analysis.

Servicing Subjects

These are subjects taught within courses offered by other faculties.

For further information regarding the following subjects see the Faculty of Architecture, Arts, Commerce, Engineering and Combined Sciences Handbooks.

27.295 Physical Geography for Surveyors **S1 L2T2**

Fundamentals of physical geography. Landscapes of Australasia. Techniques of landscape appraisal. Laboratory classes to support the above, including map analysis, air photo interpretation and examination of soil properties. There is a compulsory one-day excursion.

27.813 Geographic Methods **S2 L2T2**

Prerequisites: 27.010 and 27.030, or 27.111 or 27.050, 27.801 and 27.802, or 27.818 and 27.819. Excluded: 27.050, 27.2813.

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.

27.818 Australian Environment and Human Response **S1 L2T2**

Prerequisite: Nil. Excluded: 27.010, 27.030 27.801, 27.295, 27.111.

Themes selected from the mechanisms of the physical environment with particular reference to Australia and the Sydney region. *Landscape as an expression of dynamic response:* land capability and land use problems, humans as agents of landscape change. *Energy and Atmospheric Circulation over Australia:* local weather patterns and weather extremes, human responses to fire, flood, and drought hazards. *Development and Stability of Hillslopes:* soil, vegetation and drainage relationships, problems of soil erosion. *Coastal Ecosystems:* problems of demand, risk and management in the coastal zone. Lectures are supplemented with tutorials, workshops, and field tutorials. Students are required to provide some materials for workshop exercises and to contribute to the cost of field tutorials.

27.819 Technology and Regional Change **S2 L2T2**

Prerequisite: Nil. Excluded: 27.802.

The impact of technological change on the spatial organization of human activities and regional development and disparities. The implications of technological change on population distribution, resource utilization, and settlement patterns are examined at different scales emphasizing the social consequences at the community and regional level. Examples are taken from Third World and modernized countries, with particular reference to Australian case studies.

27.824 Spatial Population Analysis **S2 L2T2**

Prerequisite: 27.812, or 27.829. Excluded: 27.834.

Population growth and structure in an urban and regional context. The components and processes of population change; fertility, mortality and migration set within the framework of demographic transition theory. Theories of migration and mobility and of optimal populations. Demographic and social indicators for urban and regional analysis and their implications for disparities in living conditions, residential differentiation and regional growth. The adjustment of immigrant and migrant populations to the urban environment.

27.825 Urban Activity Systems **S1 L2T2**

Prerequisite: 27.812, 27.829. Excluded: 27.835.

The understanding of problems arising from processes of change in non-metropolitan areas, with particular reference to their effects on the functional structure of country towns in NSW. Topics include: functional classification, service provision, economic base, rural mobility decentralization and settlement policies, and urban systems.

27.826 Urban and Regional Development **S2 L2T2**

Prerequisite: 27.812, or 27.829. Excluded: 27.836.

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. *Lectures* accompanied by seminars and workshop sessions which concentrate on methodology.

27.827 Environment and Behaviour **S1 L2T2**

Prerequisite: 27.812, or 27.829. Excluded: 27.837.

Socio-economic and behavioural issues relating to urban development, with special reference to social impact studies and the external effects of service provision. Examples selected from inner city and suburban districts, in metropolitan areas and new towns.

27.828 Australian Natural Environments **S2 L2T2**

Prerequisite: 27.801 or 27.818. Excluded: 27.111, 27.811.

Emphasizing interdependencies of climate, hydrology, landforms, soils and vegetation. Consideration of the development of landform, soil and vegetation patterns. Classification of climates. Case studies of selected zones in Australia and comparison with neighbouring areas. Climatic analysis and mapping, and analysis of natural landscapes.

27.829 Australian Social Environments **S1 L2T2**

Prerequisite: 27.802 or 27.819. Excluded: 27.010, 27.030, 27.812.

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.

27.844 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 27.884.

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 (usually undertaken prior to Session 1) as notified by the School of Geography.

27.860 Landform Studies **S1 L2T2½**

Prerequisite: 27.301/801 or 27.111. Co-requisite: 27.311/811. Excluded: 27.183, 27.870.

Not offered in 1987.

The study of landforms, with particular reference to Australian examples. Geomorphic regions. Planation surfaces and processes and associated weathering features. The evolutionary and dynamic approaches to landforms, with particular reference to fluvial landforms. Coastal processes and forms. Desert landforms. Landforms as evidence of climatic change.

27.862 Australian Environment and Natural Resources **S1 L2T2**

Prerequisite: 27.010 and 27.030 or 27.811 or 27.812 or 27.828 or 27.829. Excluded: 27.872.

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.

27.863 Ecosystems and Man **S2 L2T2**

Prerequisite: 27.010 and 27.030, or 27.111 or 27.311/811 or 27.312/812 or 27.828 or 27.829. Excluded: 27.873, 27.363.

The structure and functioning of ecosystems, humans' interaction with ecosystems; Australian case studies of ecosystem management, including pastoral, cropping, forestry, coastal and urban ecosystems.

27.883 Special Topic **S1 or S2 L4**

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.

27.884 Advanced Geographic Methods **S1 L2T2**

Prerequisites: 27.813 or both 27.2813 and 27.2814. Excluded: 27.050, 27.880.

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.

Marketing

28.012 Marketing Systems **S1 L2T2**

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.

28.052 Marketing Research **S2 L2T2**

Prerequisite: 15.421 or approved substitute.

Sources and types of marketing information. Design, conduct, analysis and reporting of market surveys and experiments. Technique of statistical inference.

Surveying

29.441 Surveying for Engineers **S1 or S2 L2T4**

Co-ordinate systems. Levelling. Theodolite and angular measurements. Distance measurements: steel band, electronic. Traversing. Tacheometry. Contour and detail surveys. Horizontal and vertical curves. Area and volume computations. Control, engineering and underground surveys. Outline of photogrammetry.

29.491 Survey Camp

A one-week field camp for students studying 29.441 Surveying for Engineers.

Town Planning

Core Subject

36.411 Town Planning **S1 L2T1**

Architecture prerequisite: 11.4308 and 100 credit points.

Introduction to the purpose, scope and application of planning. The urban planning process. Objectives and means of planning cities. Levels of planning and types of plans: state environmental policies, regional environmental plans, local environmental plans. Problems in planning: equitable distribution of resources. Environment and environmental impact statements. Planning law and administration. Future of cities.

Landscape Architecture

Students should contact the Head of School before enrolling in any of the following subjects.

37.1606 Land Systems **S2 L2T1**

Prerequisite: 37.5003.

Ecological approach to land management. Marine, coastal, estuarine and terrestrial ecology. Conflicts with development. Statistical evaluation of human impact on undisturbed vegetation, through field work. Study of methods of management of land systems. Includes field excursions.

37.1707 Land Management **S1 L1T1**

Prerequisite: 37.1606.

An investigation of resources and their management, with reference to managed landscapes, both cultural and natural. Conservation and rehabilitation methods are studied in relation to rural and urban landscapes, including coastal processes. Rehabilitation methods are related to land use types with studies of specific examples, following investigations of human impacts and their assessment.

37.9105 Landscape Planning 1 **S1 L2T2**

Prerequisite: 37.1504.

Basic methods and techniques of resource data collection, analysis and valuation. History of landscape planning in Australia and overseas with reference to pioneering case studies. Projects include the use of maps, air photos and simple computer programs.

37.9206 Landscape Planning 2 **S2 L2T2**

Prerequisite: 37.9105.

Classification of planning methods. Study of complex methods and techniques used in recent landscape planning models. Development of land use suitability models for recreation, residential, industrial, commercial, grazing, agriculture, forestry and conservation. Projects include the use of remote sensing techniques and advanced computer programs.

37.3015 Environment Impact Assessment 1 **S1 L1T1**

2 credit points. Prerequisite: 156 credit points, or as otherwise approved by Subject Authority.

Not offered in 1987.

37.3016 Environmental Impact Assessment 2 **S2 L1T1**

2 credit points. Prerequisite: 37.3015.

Not offered in 1987.

The environment defined in terms of bio-physical and socio-economic factors. Introduction to the general principles of environmental survey and analysis and the assessment of impact. Specific methodologies are reviewed on a comparative basis. The importance of communication between the environmental sciences and professions and the problems of objectivity. Emphasis upon the role that environmental impact assessment should play as part of the planning process; landscape assessment methodologies reviewed with specific reference to their adaptability for use as a 'before and after' technique for comparatively assessing impact in relation to visual/aesthetic factors.

The student undertakes a specific study of current social significance on a group basis in two phases over two consecutive sessions, in the same year. Each phase is used as a partial assessment of progress.

School of Biological Technologies

Department of Food Science and Technology

38.122 Man and Food **S1 L1**

Food in history; world food production and trade; world food problems; world food agencies; food developmental programs. Food habits, attitudes and beliefs, food choice.

38.131 Principles of Food Preservation **S1 L4**

Prerequisites: 2.102A, 2.102B, 2.102D, 38.122, 38.421, 38.521.

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 in food preservation. Chemical and microbial stability of foods. Packaging requirements for preserved foods. Water relations of foods. Production and storage stability of intermediate moisture foods. Nutritional consequences of food processing.

38.132 Plant Food Science — S1 L3

Prerequisites: 2.102A, 2.102B, 2.102D, 38.521. Co-requisite: 38.131.

Classification, distribution, production and trade of world plant foods. The science and technology of *Fruit and vegetables:* genetic and environmental effects on composition and quality: biology of development, maturation and ripening; harvesting; concept of deterioration of fresh fruit and vegetables; technology of wine production; technology of juice and beverage production; chemical and sensory quality control procedures. *Cereals:* structure, composition and uses of wheat, rice, rye, corn, sorghum; wheat milling, flour properties; technology of bread, pasta, biscuit and cake manufacture; starch-gluten separations and derived products.

Plant-derived products. Sugars: sources, types, composition, use with other foods; sugar milling, refining; confectionery manufacture, control of spoilage. *Lipids:* sources, composition, extraction, purification processes, chemistry; processing of cooking oils, margarine, shortenings; use with other foods. *Proteins:* sources, extraction procedures, nutritional and toxicological factors, texturizing processes, use with other foods.

Methods of pest control.

38.133 Animal Food Science — S2 L2

Prerequisites: 2.102A, 2.102B, 2.102D, 38.122, 38.521.

Meat: lamb, mutton, pig, poultry. Basic science of muscle structure and function. Conversion of muscle to meat; technology and biochemistry of slaughter and development of tender meat. Composition and quality of fresh meat: water, protein, fat, vitamins and minerals. Meat preservation and microbiology: refrigerated, frozen, cured and emulsified products.

Marine products: nature and distribution of world resources; harvesting of teleostean and elasmobranch species; spoilage reactions, their control and quality assessment, chilling, freezing, salting, drying, smoking and fermentation of fishery products; fish meal and fish protein concentrates.

Egg products: structure, composition of the avian egg, quality assessment and microbiology of intact and liquid egg products. Egg pulping, freezing and drying with reference to functional and microbiological qualities.

Milk and dairy products: chemical and physical properties of milk components: proteins in colloidal and soluble fractions, enzymes, fat globules and lactose. Manipulation of these properties during production of milk-based foods: heat treatment, homogenization, coagulation.

38.134 Food Science Laboratory — F T6

Co-requisites: 10.301, 38.131, 38.132, 38.133, 38.331, 38.432

An integrated program of laboratory and pilot plant exercises designed to illustrate the principles and procedures presented in the subjects 38.131, 38.132, 38.133, 38.331 and 38.431. Includes examination and use of food processing equipment; food packaging materials; the evaluation of unit processes used in the preservation and modification of foods of plant and animal origin including fruit and vegetables, cereals, sugars, lipids, meat, fish, eggs and dairy products; their properties, uses, microbiological, chemical, biochemical and nutritional status and changes undergone during processing and storage.

38.135 Food Quality Assessment — S2 L1T2

Co-requisite: 10.301.

Food quality: review of characteristics of food quality; review of instrumental assessment of food quality. *Sensory assessment of food:* review of theories of sensory perception; practical aspects of sensory assessment such as experimental design, questionnaire design, laboratory design, choosing a test method; outline of test methods, their execution and results analysis; sensory interactions; consumer testing methodology; correlation of subjective and objective methods; case studies; field studies involving evaluation of the role of sensory assessment in the Australian food industry; laboratory exercises.

38.140 Food Technology Project — F T8

Pre- or co-requisites: 38.131, 38.132, 38.133, 38.134

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

38.141 Food Regulation and Control — S1 L3

Prerequisites: 38.131, 38.132, 38.133, 38.134, 38.331.

Food legislation: State and NHandMRC food standards and mechanisms; Codex standards; case studies in food standards development; food and nutrition policy. *Food additives:* functions and modes of action of various classes of food additives; consequences of their use; National, State and International attitudes and standards; principles of toxicological testing and evaluation of results. *Product development:* needs for new food products; role of market research, advertising and food technology in the generation of new product ideas; steps in the development of a new product; new product failure and success; practical exercises in new product development. *Microbiological quality control:* good manufacturing practice; in-plant testing; microbiological sampling; sampling plans; decision criteria; microbiological criteria for foods, hazard analysis and critical control point (HACCP) concepts, case studies.

38.142 Oenology — S1 L2T4

Prerequisite: 38.132.

History and nature of grape wines; grape and wine statistics; concept of cultivars within *Vitis vinifera;* other *Vitis* species; vine and grape physiology and biochemistry; maturity assessment and significance; influence of climate, soil, and other factors on wine quality; harvesting procedures; oenological procedures including crushing, sulphiting, pressing and draining, fermentation, maturation and storage, stabilization and clarification, bottling, packaging, and distribution; wine types and composition; quality assessment; quality control and analytical procedures; distillation and production of fortifying spirit and brandy; world wine industry, wine organizations, wine literature; social uses of alcohol.

38.143 Cereal Technology — S1 L2T4

Prerequisite: 38.132.

A treatment in greater depth of the following topics dealt with in graduate and undergraduate courses: 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. Additional topics include 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.

38.144 Treatment and Utilization of Food Processing Wastes — S2 L2T1

Ecological effects of waste discharges into the marine environment. Purification of water for domestic and industrial applications; water reuse; process modifications for effluent reduction. Origin, composition, treatment, disposal and utilization of wastes from food processing operations. Legal and economic aspects of waste disposal. Inspections of water and waste treatment plants. Seminars, assignments.

38.145 Marine Products Technology — S1 L2

Prerequisite: 38.133.

Fish species, quality control and operations used in fish canning, problems encountered with canned marine products. Fish farming, processing of carp and fish roe. Preparation of individual fish portions and utilization of commercially unattractive species. Harvesting, handling, processing and spoilage of molluscs and crustaceans. Utilization of unusual marine organisms. Industrial fishery products.

38.146 Inspections — S2 T3

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

38.149 Postharvest Technology of Fruit and Vegetables — S1 L1T5

Prerequisite: 38.132.

The systems available for the storage and handling of fruit and vegetables after harvest and the causes of wastage and deterioration in these systems. The effects of temperature, humidity, atmosphere control of the physiology and biochemistry of the product. The application of basic knowledge to develop improved commercial storage and marketing systems.

38.171 Special Topics in Meat Science — S1 T2

Prerequisite: 38.133 or equivalent.

Students will be allocated a specific area of study on an aspect of meat science involving a literature survey, industrial visits and the presentation of a seminar and a written report on the specific area of study.

38.331 Food Microbiology 1 — S1 L3

Prerequisites: 44.101 and 44.121 or other equivalent introductory Microbiology subjects.

Food spoilage: Microbial ecology of food spoilage; specific microbial associations; taxonomy of dominant species. Biochemistry and physiology of microbial growth in foods; psychrophiles, mesophiles, thermophiles, osmophiles, halophiles; production of degradative enzymes, off-flavours, odours and slimes. *Food fermentation:* Microbial fermentation of foods as a means of preservation and flavour enhancement; microbial ecology and biochemistry of food fermentations. Fermented milk, vegetables, meat and seafood products. Baker's yeast, food yeasts and yeast autolysates. Single cell protein. Microbial enzymes and polysaccharides in foods. *Food-borne microbial disease:* Foods as vectors of disease and food poisoning; incidence and occurrence, infection and intoxication. Ecology and taxonomy of common food-borne pathogenic bacteria. Food-borne viral disease. Mycotoxins. Methods of enumeration and detection of common food-borne pathogenic organisms. Indicator organisms. Control and prevention of food-borne disease, standards, legislation. Food hygiene.

38.341 Food Microbiology 2 — S2 L2T4

Prerequisite: 38.331.

A detailed theoretical and practical treatment of the ecology, taxonomy and biochemistry of bacteria, yeasts, fungi and viruses involved in food spoilage, food-borne disease and food fermentations. Emphasis on specific methodologies for the detection, enumeration and identification of food associated bacteria, yeasts and fungi. Problems of enumerating microorganisms in foods: techniques of food and surface sampling, formulation, performance and evaluation of selective-differential media, sublethal injury; the value of indicator organisms. Rapid methods for microbial enumeration and identification. Control of microorganisms in foods; microbiological quality control in food production; sanitation and disinfection; food legislation and microbiological standards.

38.344 Yeast Technology — S1 L2T1

Prerequisite: 38.331.

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.

38.421 Food Engineering 1 — S2 L2T1

Raw materials, markets, organization of the Australian food processing industries, food processing equipment, use of computers and automated control; dimensions, units, dimensionless groups, thermal and physical data of foods; material and energy balances. Includes appropriate factory inspections.

38.432 Food Engineering 2 **S1 L2T1**

Prerequisite: 38.421.

Food rheology, fluid flow; selection of fluid flow equipment; steady-state heat transfer; selection of insulation, heat exchangers; materials of construction for food processing equipment; measurement and control of process variables.

38.441 Food Technology (Chemical Engineering) **L4T3**

The science and technology of foods of plant and animal origin — fruit and vegetables, meat, fish, eggs, milk, fats and oils, cereals, sugars; their derived products with particular reference to microbiological aspects, their modification during processing and storage. Principles of food preservation with particular reference to unit processes and limiting parameters. Food spoilage, its diagnosis and control, foods in relation to disease. Food additives, food packaging. Quality characteristics of foods. Elements of human nutrition. Food regulations. Utilization and disposal of food process wastes.

38.443 Food Engineering 3 **S1 L4T2**

Prerequisites: 38.421, 38.432.

Multiple effect and vapour recompression evaporation, vapour compression and absorption refrigeration; distillation, gas absorption, liquid-liquid and liquid-solid extraction; use of computing equipment; transient heat transfer; economic decision making, specification of equipment for filtration, mixing, concentration, refrigeration and handling of foods; laboratory work involving automatic flow control, evaporation, computer control.

38.444 Computer Applications in Food Technology **S1 L1T1**

Introduction to VAX/VMS, KRONOS and other control languages; the use of SPSS, MPOS and other program packages to solve problems in food technology.

38.521 Introductory Nutrition **S1 L2T1**

Co- or prerequisite: 41.101.

Dietary patterns. Role of nutrients in human structure and function. Nutritional needs of vulnerable groups, particularly infants, children, pregnant and lactating women, the elderly. Dietary imbalance: disorders related to the affluent diet including obesity, coronary heart disease, dental caries; problems of undernutrition including protein, energy, mineral and vitamin deficiencies. Assessment of nutritional status: use of dietary allowances, food groups, tables of food composition.

38.541 Advanced Nutrition **S2 L2T1**

Prerequisite: 38.521.

Detailed study of the role of nutrients in human structure, function and disease, including study of micronutrients and trace minerals. Regulatory mechanisms such as appetite, control of nutrient metabolism and growth. Nutrition and infection. Alcoholism. Therapeutic nutrition and formulation of special dietary foods.

38.544 Nutritional Evaluation of Foods **S2 L1T5**

Prerequisites: 2.043L, 38.134.

Analytical methods for nutrients in foods, including advanced analytical techniques. Evaluation of nutrients in specific food groups, and the effect of processing and preparation on nutrient value of foods.

Biochemistry

41.101 Biochemistry **F L2½T3½**

Prerequisites: 17.041, and 2.121 and 2.131, or 2.141. Excluded: 2.003J.

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. Photosynthesis. *Practical work* to amplify the lectures.

Biotechnology

Biotechnology is a Department within the School of Biological Technologies.

42.101 Introduction to Biotechnology **S2 L2T4**

Prerequisites: 2.121 and 2.131, or 2.141; 17.041; 10.011 or 10.001 or 10.021B and 10.021C.

An introduction to biotechnology as a multidisciplinary subject, dealing with the application of biochemical systems or their products in industry. Industrial uses include: production of single products (such as amino acids, vitamins, antibiotics etc), single cell protein, alternate fuels from renewable resources and fermented foods and beverages; biological waste treatment; aspects of pollution control; biodeterioration and biodegradation; and principles of enzyme technology. Concepts relevant to productivity in these systems, including: thermodynamic feasibility, techniques of environmental and genetic manipulation, choice of the appropriate biological catalyst(s) for a particular process, regulation of gene activity. The laboratory component emphasizes the manipulation of different classes of microorganisms and the use of biochemical products involved in a variety of biotechnological areas.

42.102A Biotechnology A **S1 L2T4**

Prerequisites: 41.101 and 42.101 or 44.101 (Pass Conceded (PC) or Terminating Pass (TP) awarded prior to Session 2, 1983, is not acceptable).

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.

42.102B Biotechnology B **S2 L2T4**

Prerequisite: 42.102A (Pass Conceded (PC) or Terminating Pass (TP) awarded prior to Session 2, 1983, is not acceptable).

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 agro-industry 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.

42.102C Microbial Genetics **S1 L2T4**

Prerequisites: 41.101 or 44.101. Excluded: 43.102.

A detailed study of the mutational basis of microbial variation. Mutagens; mechanisms of mutagenesis; induction, enrichment, isolation and characterization of mutants; mechanisms of repair of mutational damage. Systems of gene transfer and recombination in fungi, bacteria and bacterial viruses; the use of these systems in constructing genetic maps, and as tools for probing aspects of microbial physiology and biochemistry. Genetic control of gene expression; the operon concept and its application to specific regulatory systems. Genetic code, collinearity between a gene and its product, genes within genes, suppression of mutations. Restriction and modification of DNA; genetic engineering — its implications and prospects. Genetics of nitrogen fixation.

42.103 Biotechnology (Honours)

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

42.114 Fermentation Processes

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.

Botany

43.111 Flowering Plants **S1 L2T4**

Prerequisites: 17.031 and 17.041.

Plant cell structure, structure and functions of the major organs in angiosperms (flowers, roots, stems and leaves), secondary thickening and arborescence, transport systems in plants, seeds and germination. Variation in structure and function in relation to environment. Introduction to taxonomy and identification of major Australian plant families. A short field excursion is part of the subject.

43.112 Taxonomy and Systematics **S2 L2T4**

Prerequisite: 43.111.

The assessment, analysis and presentation of data for classifying organisms both at the specific and supra-specific level.

43.121 Environmental Physiology **S2 L2T4**

Prerequisites: 17.031, 17.041, 2.121 and 2.131, or 2.141.

How plants function in relation to the constraints imposed on them by soil and atmospheric environments. Includes: germination, growth and development, particularly photosynthesis, respiration, inorganic nutrition, water relations, transport processes and reproductive physiology. Important practical applications of various physiological mechanisms.

43.142 Environmental Botany **S1 L2T4**

Prerequisites: 17.031 and 17.041.

The soil and atmospheric environments in which plants live and a study of the interaction of plants with their environment. Energy and mass transfer. Emphasis is placed on the role of environmental science in food production.

43.152 Plant Community Ecology **S2 L2T4**

Prerequisites: 43.111 and 17.012 or 27.111.

Recognition and delimitation of plant communities. Ecology of selected Australian vegetation types. Use of numerical methods and application of community concepts to palaeoecology. Field work is an integral part of this course.

Microbiology

44.101 Introductory Microbiology **S1 L2T4**

Prerequisites: 17.031 and 17.041.

The general nature, occurrence and importance of microorganisms. A systematic review of the major groups of microorganisms; the eucaryotic protista (micro-algae, protozoa and fungi); procaryotic protista (blue-green alfae, "higher" bacteria, typical unicellular bacteria and small bacteria-like forms); plant, animal and bacterial viruses. The relationship between microorganisms and their environment, ecological considerations. Interactions between microorganisms and higher organisms.

45.121 Evolutionary Theory **S1 L3T3**

Prerequisites: 17.031, 17.041.

Current evolutionary theory, emphasizing the population level. Ecological genetics, evolutionary aspects of ecological niche theory, speciation, evolution of social behaviour, molecular evolution and general evolutionary genetics. Some background in genetics is desirable.

Zoology

45.101 Biometry **S2 L2T4**

Prerequisites: 17.031, 17.041. Excluded: 10.311A, 10.321A, 10.331.

Statistical methods and their application to biological data, including introduction to probability; the binomial, Poisson, normal distributions; student's t, χ^2 and variance ratio tests of significance based on the above distributions, the analysis of variance of orthogonal and some non-orthogonal designs; linear regression and correlation. Non-linear and multiple regression. Introductory factorial analysis. Introduction to experimental design. Non-parametric statistics, including tests based on χ^2, the Kruskal-Wallis test, Fisher's exact probability test and rank correlation methods. Introduction to programming in BASIC.

45.121 Evolutionary Theory **S1 L3T3**

Prerequisites: 17.031, 17.041.

Current evolutionary theory, emphasizing the population level. Ecological genetics, evolutionary aspects of ecological niche theory, speciation, evolution of social behaviour, molecular evolution and general evolutionary genetics. Some background in genetics is desirable.

45.122 Animal Behaviour **S2 L2T4**

Prerequisites: 45.101, and 45.201 or 45.301.

An introduction to Ethology, the biological study of behaviour. Physiological, ecological, developmental and evolutionary aspects of behaviour are examined as important elements in the analysis of behaviour, particularly social behaviour. Both field and laboratory work are included.

45.152 Population and Community Ecology **S1 L2T4**

Prerequisites: 17.041 and 10.001 or 10.011 or both 10.021B and 10.021C.

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.

45.201 Invertebrate Zoology **S2 L2T4**

Prerequisites: 17.031, 17.041.

A comparative study of the major invertebrate phyla with emphasis on morphology, systematics and phylogeny. Practical work to illustrate the lecture course. Obligatory field camp.

45.301 Vertebrate Zoology **S1 L3T3**

Prerequisites: 17.031 and 17.021, or 17.041.

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.

45.302 Vertebrate Zoogeography and Evolution **S2 L2T4**

Prerequisite: 45.301.

A geographic approach to the current distribution, abundance and types of vertebrate species in the Australian region. Particular emphasis is placed on the basic principles of speciation, the history of the Australian continent, vertebrate adaptations and changes in the distribution and abundance of the Australian vertebrate fauna under the influence of humans. Field excursions as arranged.

45.422 Economic Zoology **S2 L2T4**

Prerequisite: 45.201 or 45.402.

A study of the biology, ecology and control of vertebrate and invertebrate animals which harm humans and their possessions. Human and domestic animal parasitology, pests on plants, diseases caused or spread by animals, chemical, biological and physical control, and side effects.

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 mightnot 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 Chemical Engineering 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.

48.001 Introduction to Chemical Industry — S1 L1T1

Introduction to the processing industry. Application of material and simple energy balances in chemical process operations. Information retrieval.

48.021 Chemical Engineering 1A

Unit 1 Flow of Fluids — **S1 L1T1**

Prerequisite: 10.001.

Introduction and units. Definitions and properties. Statics pressure distribution and measurements. Dynamics. Euler and Bernouilli equations. Momentum equations. Laminar and turbulent flow. Steady flow in pipes and equipment. Pressure losses. Flow metering. Elementary boundary layer theory. Boundary layers in pipes and on flat plates.

Unit 2 Material and Energy Balances — **F L½T½**

Prerequisite: 48.001.

A revision and extension of material and energy balance calculations with more complex examples, including those arising from stagewise operation of extraction equipment. Graphical solution of multi-stage calculations.

Students not having taken 48.001 will be required to complete a 14-hour bridging course offered by the School early in Session 1.

Unit 3 Dimensions and Dimensional Analysis — **S1 L½T½**

Prerequisites: 1.001 and 10.001.

Units and measures. Conversions of units and equations. Dimensions and Dimensional Analysis. Basic principles of modelling.

48.022 Chemical Engineering 1B

Prerequisite: 48.021.

Unit 1 Heat Transfer 1 — **S2 L1T1**

Introduction to steady state heat transfer including conduction, convection, radiation, boiling and condensation with an emphasis on problem solving. Resistance concept in heat transfer with series and parallel combinations.

Unit 2 Computation 1 — **T1 F**

A review of the fundamentals of FORTRAN, with extension to formatting, dimensioned variables and sub-routines. Application to the solution of selected problems involving heat and mass balances, fluid flow and pumping. This course is intended to be complementary to other material in 48.021 and 48.022.

Unit 3 Pumps and Pumping — **S2 L½T½**

Types of piping and fittings. Blow cases. Air lift pumps. Reciprocating pumps, centrifugal pumps and gear pumps. Blowers and compressors.

48.025 Chemical Engineering for Ceramic Engineers

Consists of Units 1 and 3 of 48.022.

48.031 Chemical Engineering 2A

Unit 1 Mass Transfer (Theory) — **S1 L1T1**

Prerequisites: 2.102A, 48.021.

Molecular diffusion in gases, liquids and solids and the measurement and calculation of diffusion coefficients. Diffusion at an interface — one component unidirectional diffusion and equimole counterdiffusion under steady state conditions. Mass transfer coefficients. Estimation and application of chemical and phase equilibria. Stage calculations applied to liquid/liquid, vapour/liquid and other mass transfer operations. The two film theory and the transfer unit concept in gas/liquid, vapour/liquid, and other operations.

Unit 2 Heat Transfer 2 (Theory) **S1 L1**

Prerequisite: 48.022 Unit 1. Co-requisite: 10.032.

An extension of the work covered in 48.022, Unit 1, with an emphasis on the fundamentals of conduction, convection and unsteady state heat transfer.

Unit 3 Plant Layout **S1 T1**

Factory Layout: Factors governing location of processing plant. Typical dispositions of process batteries, central utilities, laboratories, workshops, amenities, storage areas, effluent treatments. Distribution of electricity, steam, process and reticulated cooling water. Boiler plants and cooling towers, steam turbine versus electric motors, local versus central location of particular utilities. Provision for expansion. *Piping and Fittings:* Fabrication, standards, most used sizes and types. welded, screwed and bolted connections. common valve types, their flow and serviceabiltiy characteristics, relative costs and integrity; blinds and blanking valves. Practical assessment of pressure loss and line sizing in straight runs and simple networks involving pumps, or blowers, valves and bends. *Process Battery:* Considerations of accessability for maintenance, operator convenience and safety. Distribution of utility fluids. Methods of erecting major process units.

Unit 4 Process Engineering 1 **S1 L1**

The role of the Process Engineer. Process development, and the creation and screening of alternatives. Block diagrams and process flowsheets, presentation of material properties, mass and energy flows at various points. Preparation and critical examination of Engineering Flowsheets. Preparation of operating instructions. Process engineering (or performance) specifications for equipment items. Practice in preparation of engineering designs and drawings.

Unit 5 Safety and Failure Tolerance **S1 L1**

Co-requisite: 48.031 Unit 4.

Safe practices. Safety equipment. Handling and storage of hazardous materials. Disaster propagation, implications for plant and storage layout. Failure models, the 'bath-tub' curve. Reliability theory, replacement and standby equipment. Critera for reliability. Fault tree analysis. Accident analysis. Case histories. Factory visit.

Unit 6 Economics 1 **S1 L1**

Estimation of capital and operating costs. Components of fixed and variable costs. Break-even charts. Methods of comparing alternatives: rate of return, minimum payback time, incremental return rate, optimization. Depreciation and taxation and their effect on economic analyses. Economic design.

48.032 Chemical Engineering 2B

Unit 1 Solids Handling **S2 L1**

Prerequisite: 48.021 Unit 1.

Classification of granular solids and powders according to properties which affect their storage and movement. Storage in and retrieval from stacked piles, silos and hoppers, rules for their design. Feeders and their suitability to various kinds of granular solids. Mechanical conveyors and elevators, distance limitations; hoist height limitations. Rules for design of mechanical conveyors and elevators. Fluid-particle conveyors. Introduction to hydraulic and pneumatic conveyors, feeders and fluid-particle separation systems. Rules for design of simple slurry transportation and dilute phase pneumatic transportation systems. Practical and economic considerations determining choice of system.

Unit 2 Computation 2 **S2 L1T1**

Prerequisites: 10.301 or 10.031, 48.022 Unit 2.

Extends material given in Computation I, and places emphasis on efficient use of FORTRAN and BASIC, and use of job control language, files and programme packages. Numerical methods are considered for solving linear and non-linear algebraic equations, systems of linear equations (in particular those connected with regression analysis), ordinary and partial differential equations and simple optimization problems. Examples will be drawn from problems arising in chemical process industries; these applications will include formulation and solution of computer models of physical processes, and analysis of laboratory and plant results and fitting of empirical equations to data.

Unit 3 Engineering Thermodynamics **S2 L1**

Prerequisite: 48.135.

Engineering applications of thermodynamics. Heat engines, refrigeration.

Unit 4 Economics 2 **S2 L1**

Prerequisite: 48.031 Unit 6.

Cash flow from trade and investment. Investment, decision criteria. Cost of capital, debt and equity capital, interest rates and opportunity cost. Depreciation, investment allowances and taxation, working capital, liquidity. Discounted cash flow methods of evaluating and comparing alternatives. Comparison of these methods, replacement studies, market forecasts, total demand, leasing versus investment studies, market growth, competition and market share. Plant size and utilization, sizing for future development, simulation studies. Venture analysis, treatment of technological and commercial uncertainties, sensitivity analysis, quantifying risk and combining probabilities. Treatment of risk and ranking of ventures. Case studies.

Unit 5 Surface Separation Processes **S2 L1**

Prerequisite: 48.031 Unit 1.

Principles of membrane processes, reverse osmosis, ultrafiltration, dialysis and electrodialysis. Design calculations for batch and continuous operation of reverse osmosis and ultrafiltration equipment. Principles of sorption processes, such as adsorption ion exchange and molecular sieves. Design of fixed-bed sorption equipment. Principles and design of other surface separation processes such as foam and bubble fractionation.

48.033 Chemical Engineering 2C

Unit 1 Mass Transfer (Design) **S2 L1T½**

Prerequisite: 48.031 Unit 1.

The design of equipment for absorption, distillation and liquid-liquid extraction. Selection of column type. Design of sieve and other types of plate for plate columns. Design of packed columns. Performance characteristics of plate and packed columns. Selection of equipment for liquid-liquid extraction. Design of mixer settlers and column-type extractors. Factors affecting the performance of liquid-liquid extraction equipment. Other mass transfer equipment.

Unit 2 Heat Transfer 2 (Design) **S2 L1**

Prerequisite: 48.031 Unit 2.

Thermal design procedures for shell and tube heat exchangers and fin-fan coolers. Service fluids for heating and cooling duties.

Unit 3 Process Vessels **S2 L1T½**

Prerequisite: 8.6110.

Mechanical design and fabrication of pressure vessels. Code and legal requirements. Design of supports for vertical and horizontal cylindrical vessels. Visualization, freehand sketching and presentation of formal drawings and specifications for pressure vessels and equipment components. Relief valves, bursting discs, venting and draining systems.

Unit 4 Fluid-particle Systems 1 **S2 L1T1**

Prerequisite: 48.021 Unit 1.

Interaction between particles and fluids: drag, terminal velocity, sedimentation. Flow through porous media; pressure gradient, filtration, fluidization, dispersion; multiphase flow, irrigated packed columns.

48.036 Chemical Engineering Laboratory 1

Unit 1 and 2 **S1 T2 S2 T2**

Prerequisites: 48.021, 48.022, 2.102A.

An integrated chemical engineering laboratory incorporating experiments in fluid flow, heat transfer, mass transfer, thermodynamics and kinetics, instrumentation, process dynamics and control. The objectives of this laboratory are: to demonstrate, reinforce and extend the principles of chemical engineering which are covered in Chemical Engineering 1A and B and 2 A-C, 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.

48.039 Chemical Engineering 2J **F L1½T1½**

Comprises *three* optional units of which students must take *two*. These units are 48.0391 Electrochemical Engineering, 48.0392 Mineral Process Engineering, 48.0393 Computer Simulation. 48.0391 provides a broad introduction to electrochemistry and its use in the process industries, including caustic/chlorine manufacture and aluminium production. 48.0392 is the subject 7.023 Mineral Process Engineering augmented by an additional tutorial hour. 48.0393 provides an introduction to the use of large scale computer packages for process design and plant management.

48.040 Chemical Engineering Project **S1 T1 S2 T11**

Prerequisites: 48.031, 48.032, 48.033, 48.036, 48.135, 48.136, 48.163.

The design of plant for the production of chemicals and the estimation of product costs or an experimental investigation of some aspect of chemical engineering.

48.041 Chemical Engineering 3A

Prerequisite: 48.031.

Unit 1 Convective Mass Transfer **S1 L1**

Models for convective mass transfer are fixed and free interfaces. Calculation of mass transfer rates at surfaces with simple geometry. Mass transfer in dispersions and in systems involving chemical reaction.

Unit 2 Simultaneous Heat and Mass Transfer **S1 L1**

Psychometry, principles of design calculations for cooling towers and for humidification-dehumidification operations. Topics selected from: drying of solids, crystallization, sublimation, molecular distillation, gaseous and thermal diffusion.

Unit 3 Multicomponent Separation **S1 L1**

Prerequisites: 48.031 Unit 1, 48.135.

The separation of multicomponent systems by stagewise operations. Brief review of conventional graphical calculation methods leading to a graphical treatment of ternary distillation. Multicomponent separations using modern computer techniques. Phase equilibrium relationships for liquid-vapour and liquid-liquid systems. Azeotropes and azeotropic distillation.

Unit 4 Transport Phenomena **S1 L1**

A generalized treatment of the continuum approach to momentum, energy and mass transport. Application of the conservation equations to chemical engineering problems. Discussion of the advantages and limitations of the transport approach.

48.042 Chemical Engineering 3B

Prerequisites: 10.032, 48.163.

Unit 1 Process Dynamics and Control 1 **S1 L2T1**

Analysis of dynamic systems: derivation of equations for lumped parameter systems, linearization, reduction to transfer functions, numerical solutions. *Control hardware:* basic measuring instruments, control valves, analog controllers, digital computer-based controllers. *Process control:* analysis and synthesis of single feedback loops, using root-locus techniques, stability criteria, and criteria for satisfactory control.

Unit 2 Optimization **S1 L1**

An introduction to some of the techniques of optimization and their application to problems from the process industries. The methods covered will include single and multiple dimensional search, linear programming and dynamic programming.

48.043 Chemical Engineering 3C

Prerequisites: 48.031, 48.032.

Unit 1 Design Workshop **S1 L1T2**

Consideration of the ways and means of attempting a design project, emphasizes to students the need **1.** to study the history and alternatives to the design project, and **2.** to use proper design techniques for the assigned process and equipment. Students are each given a design project or some aspect of it and are expected to produce an appropriate report on their assignments.

Unit 2 Industrial Pollution Control **S1 L2**

Introduction, atmospheric dispersion of pollutants, source and ambient measurement and monitoring, industrial air pollution contol. Water usage in the chemical industry. Pollutants and their effects. Water quality standards. Industrial options, source reduction, water reuse, effluent disposal. Performance and selection of treatment methods. Reliability of treatment methods. Economic aspects. Legislative aspects. Factory visit. Solid waste management. Noise pollution.

48.044 Chemical Engineering Laboratory 2 **S1 T3**

Prerequisites: 48.031, 48.032, 48.033, 48.036, 48.136, 48.163.

An integrated chemical engineering laboratory at a more advanced level than the 48.036 laboratory and with an emphasis on open-ended experiments.

48.046 Chemical Engineering Project **F T6**

Prerequisites: Meritorious performance in Year 3 Chemical Engineering subjects.

48.047 Chemical Engineering 3D

Prerequisites: 48.031, 48.032, 48.033, 48.163, 48.042.

Unit 1 Management **S2 L2**

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.

Unit 2 Process Engineering 2 **S2 L1T1**

Process synthesis and analysis with particular reference to separation process sequences and heat exchanger networks. Process diagnostics: detection, location and indentification of malfunctions in a simulated chemical plant. Selection of most appropriate remedies. Studies of repair and maintenance practices, onstream corrections versus those requiring process shutdown. Temporary and permanent corrections. Exercises in fault analysis and correction using cases from practice.

Unit 3 Process Dynamics and Control 2 **S2 L1T1**

Frequency response analysis and synthesis techniques. Control of dead time and distributed systems. Cascade feedforward and other multiloop systems. Introduction to analysis of multivariable systems. Identification and estimation techniques. Digital implementation of control algorithms.

The fundamental principles of metal extraction. Oxidation and reduction, roasting, slag reactions, distillation, leaching, precipitation and electrolysis.

48.049 Automation and Optimization for Ceramic Engineers **S1 L2½T2½**

Consists of 48.165 Laboratory Automation Science and Unit 2 — Optimization of 48.042 Chemical Engineering 3B.

48.090 Industrial Experience

Students are expected to accumulate, by the end of the four year course, twelve weeks of industrial experience gained during recesses.

48.113 Chemistry of Industrial Processes **F L1T2**

Prerequisite: 2.102A. Co- or prerequisites: 2.102B, 2.102C.

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, aluminium and glass); a study of some sections of the organic industrial chemical industry — cellulose, industrial alcohols, formaldehyde, phenol, urea, phenolic and urea resins, acetic acid, polymers based on ethylene and acetylene, elastomers. *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.

48.115 Industrial Electrochemistry **S1 or S2 L2**

Prerequisites: 48.113, 48.138.

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.

48.116 Water Chemistry **S1 or S2 L2**

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

48.121 Corrosion in the Chemical Industry **S2 L2**

Prerequisite: 2.102A.

Chemical and electrical aspects of corrosion and their application to corrosion problems encountered in the chemical process industries. Selection of materials for chemical plant. Design factors for corrosion prevention. Methods of corrosion prevention.

48.122 Instrumental Analysis **S1 L1T2 S2 L1T2**

Prerequisites: 1.001, 2.121, 2.131.

Basic principles of volumetric and gravimetric analysis and the application of spectrometric and selected techniques to the analysis of process streams and quality control.

48.124 Applied Kinetics **S1 L1T1**

Prerequisites: 48.138, 48.136.

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

48.125 Industrial Chemistry 1A **S1 L1½T2½ S2 L½T½**

Comprises 48.021 Units 1 and 2.

48.126 Industrial Chemistry 1B **S1 L1 and S2 L3**

Comprises 48.022 Units 1 and 2.

48.134 Applied Thermodynamics **S1 L1T1**

Prerequisites: 48.135, 48.171.

Calculation of thermodyamic 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.

48.135 Thermodynamics **S1 L2T1**

Co- or prerequisite: 2.102A.

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.

48.136 Reactor Design 1 **S1 L1 S2 L2**

Introduction to reactor design: ideal batch, steady state mixed flow; steady state plug flow, size comparisions of ideal reactors optimization of operating conditions. Multiple reactor systems; reactors in series and parallel, mixes flow reactors of different sizes in series, recycle reactor, 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.

48.137 Industrial Chemistry 2A **S1 L2T1**

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

48.138 Industrial Chemistry 2B **S2 L2T1**

Consists of Computation 2, normally given to chemical engineering students in 48.032, and a course on chemical kinetics to complement material given in 48.136.

48.139 Experimental Design **S2 L1T1**

Design of experiments, correlation and regression, quality control. Use of graphical methods, fitting empirical equations to experimental data. Preparation of nomograms using constructional determinants.

48.143 Introduction to Analog Computation

Eight two-hour periods devoted to lectures, demonstrations and laboratory exercises. Analog computation, theory and application of analog computing elements, analog computer programming, solution of linear differential equations with constant coefficients, equation ordering and the elementary principles of modelling. Illustration by examples.

48.163 Instrumentation and Process Control 1 **S2 L2T1**

Prerequisites: 10.031, 48.122 or 2.102D. Co- or prerequisite: 48.113.

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

48.165 Laboratory Automation Science **S1 L1½T2½**

Prerequisite: 48.163.

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.

48.166 Microprocessors in Analytical Instrumentation **S1 or S2 L1T1**

Prerequisite: 1.9222. Co-requisite 48.165.

Computer interfacing to analytical instrumentation at a more fundamental level than that encountered in 48.165, Laboratory Automation Science, and is suited to students who envisage working in a research and development environment, where greater flexibiltiy and a more innovative approach are needed in data acquisition and control operations. Transducers. Instrumentation amplifiers. Signal filtering, conditioning, and processing. Data conversion systems. Principles of instrument interfacing. Interface hardware. Typical analytical instrumentation interfaces.

48.171 Chemistry of High Temperature Materials **S2 L2**

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.

48.172 Instrumental Analysis 2 **S1 L1T2**

Theory and application of: high performance liquid chromatography, G.C./mass spectroscopy, non-dispersive infra-red spectroscopy and particle size analysis. The case of continuous analysis. The interfacing of analytical instruments to computers. On-line sampling techniques with particular reference to chromatographic analyses. Water quality analysis.

48.174 Seminars **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.

48.194 Project (Industrial Chemistry) **S1 T8 S2 T16**

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

Servicing Subjects

These are subjects taught within courses offered by other faculties.

For further information regarding the following subjects see the Combined Sciences Handbook.

48.038 Chemical Engineering Principles 2 **S1 L3T1 S2 L1T1**

Prerequisite: 48.024.

The following topics, from 48.037; Mass Transfer (Theory), Heat Transfer 2 (Theory), Fluid-particle Systems, Surface Separation Processes.

48.101 Computation and Modelling in Applied Chemistry

Not offered in 1986.

For further information regarding the following subject see the Faculty of Engineering Handbook.

48.412 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.

42.311 Biological Process Engineering **F L2T4**

Prerequisite: 44.101.

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.

48.240 Biological Process Engineering Project **S1 T1 S2 T11**

Project in Biological Process Engineering for students in Chemical Engineering.

Department of Fuel Technology

48.301 Fuel Engineering (for Mining Engineers) F L2T1

An elective introductory subject in fuels and energy for Mining Engineering students based on the subject 48.311 Fuel Engineering 1, supplemented by appropriate laboratory experiments (consisting of 28 lectures and 14 hours of laboratory classes per session, taught over two sessions).

48.302 Fuels and Energy S2 L2T2

A servicing subject for students in Electrical Engineering which deals with sources and properties of fuels (with particular emphasis on coal, crude oil and natural gas), principles of combustion including combustion calculations and the technology of boilers and other fuel plant. Other energy sources including solar energy and nuclear energy are discussed. The national and global situation is reviewed.

48.303 Fuel Science for Industrial Chemists S1 or S2 L2

Units 1 and 4 of 48.321 Fuel Engineering 2.

Reaction mechanisms of various oxidation reactions. Combustion in internal combustion engines. Types of flames: laminar, turbulent, diffusion, aerated. Formation of carbon and NO in flames. Gas flow, gas analysis, solids. Measurement of temperatures of flames and surfaces. Temperature calculation: theoretical, graphical. H-t charts and their applications.

48.311 Fuel Engineering 1

Prerequisites: 1.001 or 1.011, 2.121, 2.131, or 2.141, 5.010, 5.030, 10.001 or 10.011.

Unit 1 Fuels and Energy Sources and Properties S1 or S2 L1

Fossil Fuels: coal, oil, gas; orgin, occurrence in Australia; storage, sampling and analysis; properties and their significance; classification. Other energy sources; nuclear, solar, wind, water, etc.

Unit 2 Energy Conversion S1 or S2 L1

Principles of combustion of solid, liquid and gaseous fuels. Limits of infammability, burning velocity, ignition temperature. Design principles of burners, combustion efficiency, excess air, air supply.

Unit 3 Fuel Processing S1 or S2 L1

Crude oil, refinery flow patterns. General methods of gas making. Carbonization and the production of metallurgical coke.

Unit 4 Fuel Plant Technology S1 or S2 L1

Design principles of boilers. Boiler water conditioning. Introduction to furnaces, ovens, kilns, etc.

48.321 Fuel Engineering 2

Unit 1 Combustion — Fundamentals and Science S1 or S2 L1

Reaction mechanisms of various oxidation reactions. Combustion in internal combustion engines. Types of flames; laminar, turbulent, diffusion, aerated. Formation of carbon and NO in flames.

Unit 2 Principles of Gasification S1 or S2 L1

Thermodynamics of basic reactions and calculation of equilibrium compostitions. The production of fuel and synthesis gases, controlled furnace atmospheres; gas purification.

Unit 3 Radiation Heat Transfer and Engineering Applications S1 or S2 L1

Numerical and analogue methods of problem solution in radiative heat transfer. Gas and flame radiation in combustion systems (non-luminous and luminous).

Unit 4 Measurements in Flames and Furnaces S1 or S2 L1

Gas flow, gas analysis, solids. Measurement of temperatures of flames and surfaces. Temperature calculation, theoretical, graphical, H-t charts and their application.

Unit 5 Laboratory F T1

Analysis and characterization of solid, liquid and gaseous fuels.

48.331 Fuel Engineering 3

Unit 1 Combustion Engineering S1 or S2 L1

Droplet burning, combustion of sprays. Flame stabilization. Coal combustion, burn out. Effects of fuel impurities.

Unit 2 Furnace Design S1 or S2 L1

Furnace design for continuous or intermittent operation.

Unit 3 Fuel Plant Design S1 or S2 L1

Heat recovery plant design. Flow in furnaces. Refractories. Process steam.

Unit 4 Fuel Conservation and Efficiency S1 or S2 T1

A case history and investigative approach to energy saving in industrial, commercial and domestic applications.

Unit 5 Liquid Fuels **S1 or S2 L1**

Constitution of mineral oils. Classification. Specifications. Correlation of properties. Properties of liquid fuels from petroleum and for synthesis, hydrogenation and pyrolysis of coal.

Unit 6 Coal and its Evaluation **S1 or S2 L1**

Constitution, classification and evaluation of coals. Carbonization: blending, additives, plastic behaviour.

Unit 7 Laboratory **F T3**

48.340 Fuel Engineering Project **S1 T1 S2 T11**

Projects selected involving the design of fuel plant or experimental aspects of fuel science and/or processing and utilization.

Department of Polymer Science

48.403 Polymer Science **F L2T1**

Prerequisites: 2.102A, 2.102B, 10.031, 10.301. Co- or prerequisites: 48.001, 48.113.

Polymerization processes; stepgrowth and chain growth (free radical and ionic), stereospecific catalysts. Methods of polymerization: bulk suspension, emulsion, solution, high pressure. Industrial examples. Principles of analysis of polymers using chemical and instrumental methods. Molecular weight applied to macromolecules: number-, weight-, viscosity- and z-average weights. Molecular weight distribution. Thermodynamics of polymer solutions, theta solvent. Measurement of molecular weight. Fractionation methods. Conformation of a polymer chain. The crystalline state. The amorphous state. Stress/strain behaviour. Creep. Impact. Rubber elasticity. Dynamic mechanical properties. Principles of operation of polymer processing equipment; safety procedures. Polymer compound design.

48.404 Advanced Polymer Science **S1 or S2 L2**

Prerequisite: 48.403.

Selected topics from basic texts and the original literature covering: 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.

Political Science

54.1003 Australian Political Institutions **S1 3CCH C6**

Mr J. Paul

Excluded: 54.1001, 54.1002 and 54.1006.

The nature and history of Australian political institutions in depth. The Australian constitution and federal structure and the role of the High Court in helping determine the nature of the power relationships in Australian politics. The political parties, their history, successes and failures, strengths and weaknesses both in and out of government. The formal institutions of government: parliament, cabinet, the bureaucracy and both Labor and Liberal prime ministers. Elections and voting in Australia and pressure groups.

54.1004 Government in the Modern World **S2 3CCH C6**

Dr A. Chan, Mr A. C. Palfreeman

Excluded: 54.1001.

The development, nature and forms of government in the modern world. Particular attention is paid to the major conceptual tools of political analysis with emphasis on a comparative approach to the study of government and case studies drawn from Australia and the industrialized and developing areas. An underlying theme is the management of conflict and the establishment of order in the various systems examined.

54.1005 A History of Political Thought **S2 3CCH C6**

A/Professor C. Condren

Excluded: 54.1001.

An introduction to Western political theory through the study of four major texts taken from three distinctly different political civilisations. Each text is studied against its social and intellectual background and in the context of the political crises to which it was addressed. The main themes of the lectures concern the relationship between political theory and practice and that between language and political awareness.

The texts are Plato, *The Republic*; Machiavelli, *The Prince and Discourses*; Hobbes, *Leviathan*; Locke, *The Second Treatise of Government.*

54.1006 The Australian Political System **S1 3CCH C6**

Basic concepts in political science such as power, influence and authority. Models of the Australian political system. The subsequent examination of the Australian political system is designed to illustrate these concepts and to test these models. The Australian political system is understood as the formal governmental institutions, political parties, and political culture. Australian political issues are studied to illustrate the Australian political culture.

54.2008 Public Policy Making **S2 3CCH C6**

Dr E. Thompson

Prerequisite: 54.1001 (or equivalent) or 54.1002 or 54.1003; or 51.542; or 53.033; or 54.2013.

The problems of administering government and the problems of decision making. Models of decision-making are discussed, as are problems in implementation. Areas of public policy in Australia, such as poverty and education.

Graduate Study:

Course Outlines

Graduate Enrolment Procedures

All students enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1987* available from School Offices and the Admissions Office. This booklet 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 may read for the degree in this Faculty and are normally involved in 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.

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, Corrosion Technology, Food Technology, Mining and Mineral Engineering, Textile Technology and Wool Technology.

Candidates may register for all the research degrees at Kensington subject to adequate research facilities and satisfactory supervision being available in the candidate's particular field of study. Where these special conditions can be met the Professorial Board may grant permission to a candidate to register for the degree of Doctor of Philosophy.

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.

Faculty of Applied Science

Graduate Programs in Arid Lands Management

General

The University has considerable experience of research and teaching relating to the management of arid environments, gained over many years by several of its schools. This experience is being mobilized in the provision of graduate programs based at the University campus in Kensington, Sydney, but includes significant field studies using the resources at Fowlers Gap Arid Zone Research Station in western New South Wales.

The programs include the following areas of study:
- Hydrogeology
- Land Evaluation
- Terrain Management
- Soil Conservation
- Range Management
- Management of Pastoral Enterprises

For most of the above study areas, programs are available leading to the award of:

Master of Applied Science in Arid Land Management by Course Work	Course 8025
Graduate Diploma in Arid Lands Management	Course 5025

Hydrogeology

These programs involve training in groundwater investigations, including geophysical investigations, and the assessment, development and utilization of groundwater resources. They are suited to geologists, engineers, agricultural scientists, planners and resource managers.

Land Evaluation and Terrain Management

These programs are designed to provide graduate training in the evaluation of land management and in the prediction of the environmental impact of land use. They include the two sectors of land evaluation and terrain management, with a close relationship reflected in overlapping core programs. Terrain management also embraces geopollution management, with reference to groundwater and hydrological processes. Terrain evaluation is envisaged as serving a wide range of land management, including agricultural and biological management.

Soil Conservation

These programs are designed to provide graduate training in soil conservation for land management in arid zones. They are appropriate for personnel engaged in or preparing for positions in conservation or reclamation projects, agricultural advisory services, land-use planning, administration of pastoral lands, or research into problems of arid land management.

Range Management

These programs are designed to provide graduate training in the assessment and management of rangelands, and are also relevant to animal production and soil conservation, national parks and wildlife management, and land evaluation. They are appropriate for personnel engaged in or preparing for positions in project management, pastoral advisory services, and rangeland research or administration.

Management of Pastoral Enterprises

These programs are designed to provide graduate training in the production and management of grazing sheep and beef cattle, the production of pasture, range management, and in the economic management of pastoral enterprises.

8025
Arid Lands Management
Graduate Course

Master of Applied Science
MAppSc

Hydrogeology

Prerequisite: Four-year degree of appropriate standard in geology or in a relevant science.

Compulsory Subject

25.915G Project in Hydrogeology *or*
25.916G Research Project in Hydrogeology

Recommended Core Subjects

8.842G Groundwater Hydrology
8.860G Investigation of Groundwater Resources 1
8.861G Investigation of Groundwater Resources 2
25.325 Engineering and Environmental Geology
25.702G Hydrogeology
25.711G Arid Zone Engineering Geology*

Candidates must also include additional subjects selected from core subjects in other programs in Water Resources, or from the listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Applied Geology and the Heads of the other Schools concerned, to complete a program equivalent to an average of 20 hours per week for two sessions of full-time study.

Optional Subjects

8.701G Economic Decision Making in Civil Engineering
8.703G Optimization Techniques in Civil Engineering
8.833G Free Surface Flow
8.839G Advanced Flood Estimation
8.843G Groundwater Hydraulics
8.847G Water Resources Policy
8.848G Water Resources System Design
8.849G Irrigation
8.850G Drainage of Agricultural Land
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.9226 Applied Geomorphology
27.914G Terrain Evaluation
27.910G Geomorphology of Arid Lands
27.911G Soil Erosion and Conservation
27.913G Soil Studies for Arid Lands Management
29.601G Remote Sensing Principles and Procedures
29.604G Land Information Systems

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Land Evaluation

Prerequisite: Four-year degree of appropriate standard in physical geography, or in a relevant environmental, biological or agricultural science.

Compulsory Subjects†

27.910G Geomorphology of Arid Lands
27.913G Soil Studies for Arid Lands Management
27.914G Terrain Evaluation
27.950G Project *or*
27.951G Research Project

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Geography and Heads of the other Schools concerned, to complete a program equivalent to an average of 20 hours per week for two sessions of full-time study.

Optional Subjects

9.205G Range Management‡
25.711G Arid Zone Engineering Geology*
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.911G Soil Erosion and Conservation
27.912G Arid Zone Climatology
29.601G Remote Sensing Principles and Procedures
29.604G Land Information Systems
45.900G Ecological Studies in Arid Lands Management

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

‡Includes up to one week of fieldwork, probably at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Terrain Management

Prerequisite: Four-year degree of appropriate standard in geology or physical geography, or in a relevant environmental, biological or agricultural science.

Compulsory Subjects†

25.702G Hydrogeology
25.707G Geopollution Management
25.711G Arid Zone Engineering Geology*
25.712G Project in Terrain Management *or*
25.713G Research Project in Terrain Management
27.910G Geomorphology of Arid Lands
27.914G Terrain Evaluation

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Applied Geology and Heads of the other Schools concerned, to complete a program equivalent to an average of 20 hours per week for two sessions of full-time study.

Optional Subjects

8.837G Hydrological Processes
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.911G Soil Erosion and Conservation
27.913G Soil Studies for Arid Lands Management
29.601G Remote Sensing Principles and Procedures
29.604G Land Information Systems

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Soil Conservation

Prerequisite: Four-year degree of appropriate standard in physical geography or agricultural science, or in a relevant earth science or biological science.

Compulsory Subjects†

27.910G Geomorphology of Arid Lands
27.911G Soil Erosion and Conservation
27.913G Soil Studies for Arid Lands Management
27.950G Project *or*
27.951G Research Project

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Geography and Heads of the other Schools concerned, to complete a program equivalent to an average of 20 hours per week for two sessions of full-time study.

Optional Subjects

8.864G Arid Zone Surface Water Hydrology§
8.865G Arid Zone Water Resources Management
9.205G Range Management‡
25.711G Arid Zone Engineering Geology*
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.912G Arid Zone Climatology
27.914G Terrain Evaluation
29.601G Remote Sensing Principles and Procedures
29.604G Land Information Systems
45.900G Ecological Studies in Arid Lands Management

§Co-requisites 8.837G Hydrological Processes
8.838G Flood Design

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Geography and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

9.205G Range Management‡
25.711G Arid Zone Engineering Geology*
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.911G Soil Erosion and Conservation
27.912G Arid Zone Climatology
29.601G Remote Sensing Principles and Procedures
29.604G Land Information Systems
45.900G Ecological Studies in Arid Lands Management

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

5025
Arid Lands Management
Graduate Diploma Course

Graduate Diploma
GradDip

Hydrogeology

Prerequisite: Degree in engineering or geology or in a relevant science.

Recommended Core Subjects

As for **8025** MAppSc degree Hydrogeology strand (see earlier this section).

Candidates must also include additional subjects selected from core subjects in other programs in Water Resources, or from the listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the Department of Applied Geology and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

As for **8025** MAppSc degree Hydrogeology strand (see earlier this section).

Land Evaluation

Prerequisite: Degree in physical geography or geology, or in a relevant environmental, biological or agricultural science.

Compulsory Subjects†

27.910G Geomorphology of Arid Lands
27.913G Soil Studies for Arid Lands Management
27.914G Terrain Evaluation
27.950G Project

Terrain Management

Prerequisite: Degree in geology or physical geography, or in a relevant environmental, biological or agricultural science.

Compulsory Subjects†

25.711G Arid Zone Engineering Geology*
25.712G Project in Terrain Management
27.910G Geomorphology of Arid Lands
27.914G Terrain Evaluation

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the Department of Applied Geology and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

8.837G Hydrological Processes
25.702G Hydrogeology
25.707G Geopollution Management
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.911G Soil Erosion and Conservation
27.913G Soil Studies for Arid Lands Management
29.601G Remote Sensing Principles and Procedures
29.604G Land Information Systems

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Soil Conservation

Prerequisite: Degree in physical geography or agricultural science, or in a relevant earth science or biological science.

Compulsory Subjects†

27.910G Geomorphology of Arid Lands
27.911G Soil Erosion and Conservation
27.913G Soil Studies for Arid Lands Management
27.950G Project

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Geography and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

8.865G Arid Zone Water Resources Management
9.205G Range Management‡
25.711G Arid Zone Engineering Geology*
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.912G Arid Zone Climatology
27.914G Terrain Evaluation
29.601G Remote Sensing Principles and Procedures
29.604G Land Information System
45.900G Ecological Studies in Arid Lands Management

†Compulsory subjects jointly include one week of fieldwork, probably at Fowlers Gap Research Station.

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

*Includes a field exercise of at least three days duration at Fowlers Gap Research Station.

Range Management††

Prerequisite: Degree in agricultural science, or in a relevant biological or earth science.

Compulsory Subject

9.205G Range Management‡

Recommended Subject**

45.900G Ecological Studies in Arid Lands Management

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Wool and Pastoral Sciences and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

9.105G Livestock Production
9.113 Livestock Production 2
9.202 Pastoral Agronomy
9.421 Animal Nutrition
27.043G Remote Sensing Applications
27.171G Directed Problems in Remote Sensing
27.174G Remote Sensing Instrumentation and Satellite Programs
27.910G Geomorphology of Arid Lands
27.911G Soil Erosion and Conservation
27.912G Arid Zone Climatology
27.913G Soil Studies for Arid Lands Management
27.914G Terrain Evaluation
29.601G Remote Sensing Principles and Procedures
29.604G Land Information Systems
43.121 Plant Physiology
43.142 Ecology and Environmental Botany
45.122 Animal Behaviour

**This subject may be omitted with permission of the Head of the School of Wool and Pastoral Sciences.

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

Management of Pastoral Enterprises

Prerequisite: Degree in veterinary or agricultural science, or in a relevant biological science.

Recommended Subjects

9.105G Livestock Production
9.205G Range Management‡

Candidates must also include additional subjects selected from the following listed optional subjects, or from other relevant subjects offered within the University, as approved by the Head of the School of Wool and Pastoral Sciences and Heads of the other Schools concerned, to complete a program equivalent to an average of 18 hours per week for two sessions of full-time study.

Optional Subjects

9.001 Project in Management of Pastoral Enterprises
9.113 Livestock Production 3
9.131 Animal Health 1
9.132 Animal Health 2
9.202 Pastoral Agronomy
9.301 Agricultural Economics and Management 1
9.302 Agricultural Economics and Management 2
9.421 Animal Nutrition
9.503 Wool Science 3
9.504G Wool Science
9.802 Genetics 2
9.803G Animal Breeding
9.811 Biostatistics 1
9.812 Biostatistics 2
9.813G Quantitative Methods
9.901 Rural Extension
45.122 Animal Behaviour
45.900G Ecological Studies in Arid Lands Management

‡Includes up to one week of fieldwork at Fowlers Gap Research Station.

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, physical geography, geology, surveying, or in a relevant environmental biological or agricultural science.

Course requirements Candidates are required to complete a course totalling at least 36 credits, made up of compulsory subjects, elective subjects and a project or research project. Compulsory subjects not offered in a particular year may be substituted by an equivalent subject, approved by the appropriate Head of School. The degree will normally comprise one year of full-time study (two sessions of 18 credits) or two years of part-time study (four sessions of 9 credits each).

Candidates who are not exempted from any of the compulsory subjects and who opt for the Research Project (18 credits), will achieve the required 36 credits without any elective subjects.

Compulsory Subjects		Credits
6.580G	Image Analysis in Remote Sensing	3
6.587G	Computer Techniques in Remote Sensing	3
27.043G	Remote Sensing Applications	3
29.601G	Remote Sensing Principles and Procedures	6
29.605G	Ground Investigations for Remote Sensing	3

Project		
46.101G	Project in Remote Sensing *or*	9
46.102G	Research Project in Remote Sensing	18

Elective Subjects

Candidates are required to include additional subjects selected from the following listed elective subjects, or from other relevant subjects offered within the University, as approved by the appropriate Head of School, to complete a program totalling 36 credits.

		Credits
6.070G	Digital Image Processing Systems	3
6.468G	Computer Display Systems and Interactive Instrumentation	3
6.581G	Microwave Remote Sensing	3
6.611	Computing 1	4
6.621	Computing 2A	3
25.816G	Remote Sensing in Applied Geology	2
27.500	Mathematical Methods for Spatial Analysis	4
27.644G	Computer Mapping and Data Display	3
27.672G	Geographic Information Systems	3
27.911G	Soil Erosion and Conservation	6
29.530G	Analytical Photogrammetry	3
29.604G	Land Information Systems	3

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 a minimum of 30 credits or equivalent to 15 hours per week for two sessions of full-time study, made up of compulsory subjects (15 credits) and elective subjects (15 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
6.580G	Image Analysis in Remote Sensing	3
29.600G	Principles of Remote Sensing	3
29.605G	Ground Investigations for Remote Sensing	3
27.174G	Remote Sensing Instrumentation and Satellite Programs	3
27.043G	Remote Sensing Applications	3

Elective Subjects

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

6.070G	Digital Image Processing Systems	3
6.468G	Computer Display Systems and Interactive Instrumentation	3
6.581G	Microwave Remote Sensing	3
6.587G	Computing Techniques in Remote Sensing Image Analysis	3
8.837G	Hydrological Processes	3
8.849G	Irrigation	3
8.861G	Investigation of Ground Water Resources 2	3
8.864G	Arid Zone Hydrology	3
8.865G	Arid Zone Water Resources Management	3
25.704G	Environmental Geology	3
25.801G	Geology in Exploration 1	4
25.816G	Remote Sensing (in Applied Geology)	2
25.821G	Geology in Exploration 2	2
27.171G	Directed Problems in Remote Sensing	3
27.644G	Computer Mapping and Data Display	3
27.914G	Terrain Evaluation	3
29.503G	Analytical Photogrammetry	3
29.604G	Land Information Systems	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 resoluton.

The course is designed around three broad components for a minimum of 40 credits (1 credit = 1 hour per week per one session):

- Core subjects (10 credits)
- Project (10 or 20 credits)
- Electives (10 or 20 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
27.202G	Environmental Planning and Evaluation	3
36.945G	The Organization of Town Planning	2
46.203G	Medical Aspects	2
46.204G	Legislative Aspects	2

Project

46.200G	Research Project in Environmental Studies	20
or		
46.201G	Project in Environmental Studies	10

Elective Subjects

Earth Science — Engineering

8.021	Environmental Aspects of Civil Engineering	3
8.847G	Water Resources Policy	3
25.704G	Environmental Geology	3
25.707G	Geopollution Management	3
25.710G	Coastal Environmental Geology	3
27.043G	Remote Sensing Applications	3
27.133	Pedology	5
27.171G	Directed Problems in Remote Sensing	3
27.174G	Remote Sensing Instrumentation and Satellite Programs	3
27.183	Geomorphology	5
27.902G	Meteorological and Hydrological Principles	3

Chemistry — Biology

		Credits
2.043A	Environmental Chemistry	6
2.251G	Toxicology, Occupational and Public Health	6
9.424G	Minerals and Their Effects on Grazing Animals	2
27.143	Biogeography	5
27.153	Climatology	5
42.212G	Principles of Biochemistry	3
43.142	Ecology and Environmental Botany	6
48.063G	Industrial Water and Wastewater Engineering	3
48.386G	Unit Operations in Waste Management	3
48.391G	Atmospheric Pollution Control	3
48.392G	Practical Aspects of Air Pollution Measurement and Control	3

Social-Economic-Planning

8.402G	Transport, Environment, Community	6
8.403G	Theory of Land Use/Transport Interaction	3
27.923G	Population, Health and Environment	2
30.935G	Organization Behaviour A	3
30.958G	Organizational Communications	3
30.960G	Technology and Organizations	3
36.311	Environmental Psychology	4
37.3015	Environmental Impact Assessment 1	2
37.3016	Environmental Impact Assessment 2	2
37.1606	Land Systems	3
37.1707	Land Management	2
37.9105	Landscape Planning 1	4
37.9206	Landscape Planning 2	4
39.908G	Community Noise Control	2
85.716G	Public Policy	3
85.721G	Economics of Natural Resources	2

School of Biological Technologies

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

In addition, the School welcomes enquires 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

5320
Biochemical Engineering Graduate Diploma Course*

Graduate Diploma
GradDip

The Department offers a course in biochemical engineering which leads to the award of a graduate diploma (GradDip). The course is open to graduates in the biological sciences, chemistry, chemical engineering or agriculture, and can be completed in one year of full-time or over a longer period by part-time study. It contains a component of graduate level 'bridging' subjects, designed to facilitate the introduction of graduates with a variety of backgrounds to the current practice of biochemical engineering.

The normal entrance requirement is an appropriate degree or equivalent qualification in biological sciences, chemistry, chemical engineering or agriculture. Intending students are referred to the conditions for the award of Graduate Diplomas set out later in this handbook.

*This course is being revised. Contact the Department for further details.

		Hours per week S1	S2
Session 1			
42.211G	Principles of Biology	3	0
42.212G	Principles of Biochemistry	3	0
42.282G	Thermodynamics	4	0
42.284G	Mass Heat and Momentum Transfer	4	0
44.101	Introductory Microbiology	6	0
Session 2			
42.213G	Biochemical Methods	0	3
42.214G	Biotechnology	0	3
42.283G	Process Dynamics and Biochemical Engineering Design	0	8

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 19 hours per week, or two years part-time study, consisting of an average of 9½ 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.

*This course is being revised. Contact the Department for further details.

		Hours per week S1	S2
Obligatory Subjects			
Full Year			
42.215G	Practical Biotechnology	7	7
Session 1			
42.102A	Biotechnology A	6	
Elective Subjects			
Full Year			
42.104G	Graduate Seminars	2	2
42.111G	Reading List in Biotechnology (Biochemistry	3	3
42.112G	Reading List in Biotechnology (Biochemistry)	3	3
42.305G	Case Studies	0	2
Session 1			
42.101	Introductory Microbiology	6	
42.212G	Principles of Biochemistry	3	
Session 2			
42.101	Introduction to Biotechnology		6
42.102B	Biotechnology B		6
42.121	Microbiology 1		6

8041
Master of Science (Biotechnology) Graduate Course*

Master of Science (Biotechnology)
MSc(Biotech)

The Department also offers a formal graduate course at the masters' level (Master of Science (Biotechnology)). 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 supervized 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.

To qualify for the degree students must satisfy the examiners in the prescribed examinations, which include the submission and assessment of a report on the specified project.

*This course is being revised. Contact the Department for further details.

		Hours per week S1	S2
Full Year			
42.306G	Project	7	7
Session 1			
42.303G	Biochemical Process Control	5	0
42.304G	Biodeterioration and Biodegradation	5	0
Session 2			
42.301G	Microorganism Productivity	0	5
42.302G	Enzyme Technology	0	5
42.305G	Case Studies	0	2
		17	19

8000
Bioprocess Engineers Graduate Courses

Master of Applied Science
MAppSc

These courses are being revised. Contact the Department for further details.

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.

8030
Food Technology Graduate Course*

Master of Applied Science
MAppSc

This course provides for a comprehensive study of theoretical and applied aspects of the science and technology of foods. The course is formal and elective in nature, providing an opportunity for graduates to apply their basic skills in areas relevant to this field of applied science, and is particularly relevant to graduates in agriculture, applied science and science with principal interests in chemistry, biochemistry, microbiology, physiology, nutrition and chemical engineering.

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 per cent of the total program. This would include a project constituting not less than 15 per cent and not more than 50 per cent of the program.

2. A minor strand of broader-based supporting material making up to 25 per cent of the total program.

Undergraduate material may be included in one or both strands but may not exceed 25 per cent of the total program. Approximately 60 per cent of the program (including the project) must be taken in the School of Biological Technologies. The remainder, subject to approval and availability, may be undertaken in other schools within the University.

*This course is being revised. Contact the Department for further details.

Graduate subjects in Food Science and Technology may be selected from:

		Hours per week*
38.151G	Introductory Food Science	1
38.152G	Food Process Laboratory	3
38.153G	Food Technology Seminar	1
38.155G	Dairy Technology	2
38.156G	Oenology	1
38.157G	Technology of Cereal Products	1
38.158G	Marine Products	1
38.161G	Food Additives and Toxicology	1
38.162G	Postharvest Physiology and Handling of Fruit and Vegetables	3
38.164G	Elements of Food Preservation	2½
38.165G	Plant Food Products	1½
38.166G	Animal Food Products	1
38.350G	Food Microbiology	2
38.351G	The Microbial Ecology of Foods	3
38.451G	Advanced Food Engineering	1½
38.452G	Drying of Foods	1½
38.551G	Advanced Nutrition	1½
38.552G	Methods of Nutritional Assessment and Analysis	3
38.553G	Principles of Nutrition	2
38.900G	Major Project	6
38.901G	Minor Project	3

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

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.

8035
Food Engineering Graduate Course*

Master of Applied Science
MAppSc

This course is designed for graduates who have a degree in Engineering or a related field of study, and an interest in the processing of biological resources.

The formal components of the course provide professional training at an advanced level in food science and in food engineering. The studies in food science deal with nutrition, food chemistry, microbiology, food preservation and the technology of plant, animal and marine foods. These subjects have been specially prepared and no previous experience in these areas is necessary. The studies in food engineering are designed to strengthen and broaden the engineering background of graduates and will emphasize the use of fundamental principles in solving problems associated with food processing.

Problem-solving skills are further developed in a research project devoted to an area of food engineering.

The course requires three sessions of full-time study. The details of the course are as follows:

		Hours per week*
Session A		
38.701G	Man's Food	1
38.702G	Food Engineering A	4
38.703G	Food Engineering B	3
38.704G	Food Chemistry and Enzymology	3
38.705G	Introductory Food Microbiology	2
38.706G	Food Storage and Preservation	2
38.707G	Reading Assignment	1
		16
Session B		
38.708G	Food Engineering C	4
38.709G	Technology of Food Drying	3
38.710G	Science and Technology of Animal Products	3
38.711G	Science and Technology of Plant Products	3
38.712G	Food Engineering Laboratory	3
38.713G	Human Nutrition	1
38.714G	Literature Survey	1
		18
Session C		
38.700G	Major Project	8
38.715G	Food Engineering Field Work	3
	Elective Material	6
		17

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

Elective material may be selected from any subject offered by the University, subject to approval by the Head of the School. The Australian Government, through the Australian Development Assistance Bureau (ADAB), Department of Foreign Affairs, recognizes and supports this course as an Australian Development Assistance Course. Nominations for Australian awards to overseas graduates are considered only when made by national governments and submitted through the local Australian diplomatic mission.

* The course is being revised. Contact the Department for further details.

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 the 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 (17 hours/week), or two years of part-time study (8½ hours/week). It involves the following program:

		Hours per week*
38.151G	Introductory Food Science	1
38.152G	Food Process Laboratory	3
38.164G	Elements of Food Preservation	2½
38.165G	Plant Food Products	1½
38.166G	Animal Food Products	1
38.350G	Food Microbiology	2
38.553G	Principles of Nutrition	2
	Electives†	4

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

†Electives are to be selected from the following list of subjects according to availability and with the approval of the Head of School.

2.271G	Chemistry and Analysis of Foods	3
38.142	Oenology	3
38.144	Treatment and Utilization of Food Processing Wastes	1½
38.157G	Technology of Cereal Products	1
38.158G	Marine Products	1
38.162G	Postharvest Physiology and Handling of Fruit and Vegetables	3
38.341	Food Microbiology 2	3
38.344	Yeast Technology	1½
38.432	Food Engineering 2	3
38.443	Food Engineering 3	3
38.551G	Advanced Nutrition	1½
38.552G	Methods of Nutritional Assessment and Analysis	3
42.102A	Biotechnology A	3
42.211G	Principles of Biology	1½
42.212G	Principles of Biochemistry	1½
42.213G	Biochemical Methods	1½
42.214G	Biotechnology	1½
44.101	Introductory Microbiology	3

or such other electives approved by the Head of School. In all cases the hours devoted to graduate subjects constitute at least 50 per cent of the total course hours.

School of Chemical Engineering and Industrial Chemistry

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 (generally designated as subjects without a suffixed G number), 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.

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 (48.900G) amounting to six hours per week for a year or take a Minor Project (48.901G) 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 engineering for graduates in science, applied science or engineering who have not had substantial previous formal education in these subjects.

The course is based on the general formula for a MAppSc degree program, whereby the subjects 48.311 and 48.321 can comprise the 25% undergraduate component, the project (30% or 15% of the program) is 48.900G or 48.901G, and the remainder of the hours can be taken from the units offered in the 48.38-G and 48.39-G 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.

5010
Corrosion Technology Graduate Diploma Course

Graduate Diploma
GradDip

The Graduate Diploma course in Corrosion Technology is open to graduates in Engineering, Applied Science or Science who wish to undertake formal studies to promote their careers in industry. At present it may only be taken as a two-year part-time course and is offered every second year.

The course is designed for those professionals in industry who are faced with the problem of combating corrosion. Its aim is to develop an appreciation of the fundamentals, principles of corrosion and of the available methods of overcoming it.

For graduates from Engineering (non-chemical) or Science (in a particular major) a bridging course may be necessary.

Year 1 of the course introduces elementary aspects of corrosion technology and suitably orientates students depending on their initial qualifications. Year 2 of the course contains more detailed instruction at a graduate level in corrosion theory and prevention, together with a suitable project.

*For additional information on the MAppSc degree course see earlier this section.

Year 1		Hours per week S1	S2
48.121	Corrosion in the Chemical Industry	0	2
48.180G	Corrosion Materials	2	2
48.181G	Industrial Coatings for Corrosion Protection	2	0
		4	4
Year 2			
48.171	Chemistry of High Temperature Materials	0	2
48.182G	Non-metallic Materials for Corrosion Resistance	2	0
48.183G	Corrosion Technology	3	3
48.184G	Corrosion Project	6	6
		11	11

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.

School of Fibre Science and Technology

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 him 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.

One of the principle functions of the course is to provide professional training for graduates who wish to work in the field of textile technology. It will also provide formal studies for graduates who have been employed in the industry for some years. A further function is to provide advanced studies in textile technology for non-graduates holding approved textile qualifications.

The normal requirement for admission to the course is a degree in science or engineering. Applicants with a degree in commerce, arts or education or who have obtained Associateship of the Textile Institute or Associateship of the Society of Dyers and Colourists, or who hold other qualifications approved by the Higher Degree Committee are also eligible for admission, but may be required to take specific elective subjects as directed by the Head of the School.

Two options are available, allowing candidates to specialize either in the theory and practice of yarn and fabric technology (engineering/physics orientation) or in the science and technology of textile dyeing and finishing (chemistry orientation).

Each of the following programs, which comprizes both formal lectures and laboratory work, may be taken as a one year full-time course or two-year part-time course. Variations from these programs may be possible, subject to the approval of the Head of School.

		Hours per Week*
Option A		
Yarn and Fabric Technology		
13.701G	Fibre Science	1
13.702G	Textile Testing and Quality Assurance	3
13.703G	Yarn Technology	3
13.704G	Fabric Technology	3
13.901G	Dissertation	2
	Electives†	6
Option B		
Technology of Textile Dyeing and Finishing		
13.701G	Fibre Science	1
13.702G	Textile Testing and Quality Assurance	3
13.705G	Finishing Technology	3
13.706G	Dyeing Technology	3
13.901G	Dissertation	2
	Electives†	6

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

†Electives are to be selected from relevant subjects offered within the University, subject to availability and with the approval of the Head of School.

In certain cases, candidates may replace some of the specified subjects with additional elective material (up to a total of 9 hours elective material), or select subjects from both options, subject to the approval of the Head of the School.

Department of Wool Science

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
9.105G	Livestock Production	6
9.205G	Range Management	4
9.504G	Wool Science	6
9.803G	Animal Breeding	4
9.813G	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.

School of Materials Science and Engineering

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 and metallurgical engineering or ceramic engineering or who are interested in programs involving formal course work and research leading to the award of Graduate Diploma in Materials.

The Head of the School is pleased to give information about research scholarships, fellowships and grants-in-aid. 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 20½ 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 grduate 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 4.044, Professional Electives with extensions as appropriate to the graduate level.

Compulsory Subjects

		Hours per week S1	S2
4.044	Professional Electives	5	5
4.201G	Graduate Seminar	2	2
4.241G	Graduate Materials Project	6	6
4.633	Metallurgical Engineering 2C	3½	3½
		16½	16½

Elective Graduate Subjects*

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

4.211G	Metallurgical Practice		
4.221G	Advanced Metallurgical Techniques		
4.231G	Advanced Theoretical Metallurgy		
4.251G	Advanced Materials Technology	4	4
		20½	20½

*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.

School of Mines

Department of Applied Geology

8020
Engineering Geology-Hydrogeology-Environmental Geology Course

Master of Applied Science
MAppSc

The course consists of a Project (Group A) and six subjects chosen from Group B, at least one of which must be 25.702G Hydrogeology, 25.704G Environmental Geology, or 25.708G Engineering Geology. In special cases, eg where students have achieved a satisfactory standard in Geomechanics, those students taking 25.708G Engineering Geology and/or 25.714G Geology of Foundations, may select in place of 25.706G *either* another subject from Group B, *or* one subject from another Faculty, provided such a subject is relevant to the course.

The Project normally consists of field and laboratory work, and is related to the student's major interest. Students must consult the Professor of Engineering Geology for approval of the Project.

Group A		Hours per week S1	S2
25.703G	Project (Engineering Geology Graduate Course)	0	18

Group B		Hours per week	
25.702G	Hydrogeology	3	0
25.704G	Environmental Geology	3	0
25.705G	Engineering Geophysics	3	0
25.706G	Geological Basis of Geomechanics	3	0
25.707G	Geopollution Management	3	0
25.708G	Engineering Geology	3	0
25.710G	Coastal Environmental Geology	3	0
25.714G	Geology of Foundations	3	0
27.904G	Geomorphology for Engineering Geologists	3	0

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 on their qualifications) may be required to take a Special Project, 25.000G, either as a pre- or co-requisite. The courses within the three units may be varied at the discretion of the Head of the School to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)

25.800G Seminar
25.801G Geology in Exploration 1
25.802G General Introduction to Exploration Geophysics
25.803G Introduction to Exploration Geochemistry
25.804G Introduction to Data Processing and Interpretation
25.805G Resource Economics 1
and either
25.807G Exploration Geophysics
or
25.808G Exploration Project
or
7.013* Principles of Mining
and
7.044* 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)

25.811G Advanced Geology in Exploration
25.815G Resource Economics 2
25.816G Remote Sensing
25.817G Mining Law and Exploration Management
25.840G Seminar
7.001G Exploration Drilling
and either
7.013* Principles of Mining
and
7.044* Mining Economics
or
25.818G Exploration Project

*These are one session subjects, ie weeks 1-14.

Unit C (Session 2)

25.819G 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 25.000G either as a pre- or co-requisite. The courses within the three units may be varied at the discretion of the Head of the School to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)

25.800G Seminar
25.801G Geology in Exploration 1
25.802G General Introduction to Exploration Geophysics
25.803G Introduction to Exploration Geochemistry
25.804G Introduction to Data Processing and Interpretation
25.805G Resource Economics 1
25.807G Exploration Geophysics

Seven days field tutorials are an integral part of Unit A.

Unit B (Weeks 8-14 Session 1)

25.831G Geological Interpretation
25.832G Advanced Exploration Geophysics
25.840G Seminar

Unit C (Session 2)

25.839G 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, 25.000G, either as a pre- or co-requisite. The courses within the three units may be varied at the discretion of the Head of the School to suit the requirements of individual students.

Unit A (Weeks 1-7 Session 1)

25.800G Seminar
25.801G Geology in Exploration 1
25.802G General Introduction to Exploration Geophysics
25.803G Introduction to Exploration Geochemistry
25.804G Introduction to Data Processing and Interpretation
25.805G Resource Economics 1
and either
*7.013** *Principles of Mining*
and
*7.044** *Mining Economics*
or
25.808 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)

25.821G Geology in Exploration 2
25.823G Advanced Exploration Geochemistry
25.824G Advanced Data Processing and Interpretation
25.827G Laboratory methods
25.840G Seminar
and either
*7.013** *Principles of Mining*
and
*7.044** *Mining Economics*
or
25.828G Exploration Project

*These are one session subjects, ie weeks 1-14.

Unit C (Session 2)

25.829G Field — Laboratory Project

Department of Mining Engineering

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 nine to ten hours of lectures per week, depending on the subjects chosen, for two years on a part-time external basis. Not less than 20 per cent of the total program consists of a project on an approved topic covering a field or laboratory investigation of a mining geomechanics problem.

Three of the subjects, in addition to the project, form a compulsory core strand. These are augmented by a range of elective, optional subjects. A grouping of five options (including selections from undergraduate subjects, where appropriate) may 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.

Core Subjects		Hours per week S1	S2
7.515X	Rock Mechanics Measurements	3	3
7.525X	Strata Control Engineering	3	0
8.776G	Rock Mechanics	0	3
Project			
7.455X	Mining Geomechanics Project	4	4
Optional Subjects			
Group A			
7.535X	Mine Fill Technology	2	2
7.545X	Advanced Rock Cutting Technology	2	2
7.555X	Blasting Technology	2	2
7.565X	Rock Slope Stability*	2	2
7.575X	Subsidence Engineering	2	2
7.585X	Economics and Management of Geomechanics Projects	2	2
Group B			
8.777G	Numerical Methods in Geomechanics	0	3
8.778G	Geotechnical Processes for Energy Resources**	3	0
25.702G	Hydrogeology	0	3
25.706G	Geological Basis of Geomechanics	3	0
25.708G	Engineering Geology	3	0

*Subject not available in 1987.

**Offering to be reviewed.

The program is arranged as follows:

Year 1

The core subjects are taken, together with any approved combination consisting of *either* two options from Group A *or* one option each from Group A and Group B. In certain cases optional subjects may be replaced by undergraduate subjects up to a total of 25 per cent of the total program, subject to the approval of the Head of Department.

Year 2

The project is carried out in Year 2, together with the remaining options or undergraduate subjects of the approved program.

Students may take three options from Group A *or* two options from Group A and one from Group B *or* one option from Group A and two Options from Group B.

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.

Year 1 — Part-time

		Hours per week S1	S2
7.013	Principles of Mining	2	0
7.234	Mineral Economics	1	1
7.111G	Mining Engineering	3	3
7.311G	Mineral Beneficiation	0	3
7.714	Mineralogical Assessment	1	0
7.7341	Mineral Process Engineering	2	0
		9	7

Year 2 — Part-time

7.122G	Mining Engineering Technology *or*	3	3
7.322G	Mineral Beneficiation Technology	3	3
7.132G	Mining Engineering Laboratory and Project *or*	3	3
7.332G	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.

Centre for Waste Management

The University established the Centre within the Faculties of Engineering and Applied Science to co-ordinate and develop teaching and research in the multi-disciplinary area of waste management.

The course may be taken over one year on a full time basis, or over two years on a part-time basis. Part-time study will require release from employment for an average of one afternoon or morning per week during the University session.

A Graduate Diploma, Master of Applied Science and Master of Engineering Science in Waste Management are available on an external basis. Resources relevant to the subjects would be mailed to the students and assessment would be mainly by written assignment. A one-week residential course would be given each May to provide supplementary instruction and assessment.

Programs are available leading to the award of Master of Applied Science in Waste Management Course 8085, Graduate Diploma in Waste Management Course 5070, or, in the case of Engineering, Master of Engineering Science.

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 or a Research 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. A candidate must normally complete 18 credits of core subjects.

Core Subjects		Credits	Session
8.872G	Management of Wastes	3	2
8.873G	Waste and Wastewater Analysis and Environmental Requirements	3	1
8.874G	Waste Management Science	3	1
25.715G	Sources of Waste and Landfill Disposal	3	1
48.067G	Treatment, Disposal and Resource Recovery of Solid and Liquid Wastes	3	2
48.388G	Unit Operations in Wastewater Sludge and Solids Management	3	1

Elective Subjects

7.152G	Mining Conservation
7.535X	Mine Fill Technology
7.916G	Atmospheric Pollution Control (Theory)
7.917G	Atmospheric Pollution Control (Practical Aspects)
8.857G	Sewage Treatment and Disposal
8.870G	Hydraulics and Design of Water and Wasterwater Treatment Plants
25.702G	Hydrogeology
25.707G	Geopollution Management
25.704G	Environmental Geology
46.203G	Medical Aspects
46.204G	Legislative Aspects
46.512G	Project in Waste Management
46.513G	Research project in Waste Management
47.481G	Introduction to Safety Engineering
47.120G	Human Behaviour and Safety Science
48.063G	Industrial Water and Wastewater Engineering

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. A candidate must normally complete 18 credits of core subjects.

Core Subjects		Credits	Session
8.872G	Management of Wastes	3	2
8.873G	Waste and Wastewater Analysis and Environmental Requirements	3	1
8.874G	Waste Management Science	3	1
25.715G	Sources of Waste and Landfill Disposal	3	1
48.067G	Treatment, Disposal and Resource Recovery of Solid and Liquid Wastes	3	2
48.388G	Unit Operations in Wastewater Sludge and Solids Management	3	1

Elective Subjects

7.152G Mining Conservation
7.535X Mine Fill Technology
7.916G Atmospheric Pollution Control (Theory)
7.917G Atmospheric Pollution Control (Practical Aspects)
8.857G Sewage Treatment and Disposal
8.870G Hydraulics and Design of Water and Wastewater Treatment Plants
25.702G Hydrogeology
25.707G Geopollution Management
25.704G Environmental Geology
46.203G Medical Aspects
46.204G Legislative Aspects
46.511G Report in Waste Management
47.481G Introduction to Safety Engineering
47.120G Human Behaviour and Safety Science
48.063G Industrial Water and Wastewater Engineering

Graduate Study:

Subject Descriptions

Identification of Subjects by Number

A subject is defined by the Professorial 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'.

Each approved subject of the University is identifiable both by number and by name as this is a check against nomination of subject other than the one intended.

Subject numbers are allocated 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 number before the decimal point.

2. Each subject number 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.

4. Graduate subjects are indicated by a suffix 'G' to a number with three digits after the decimal point. In other subjects three or four digits are used after the decimal point.

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.

The **identifying numerical prefixes** for each subject authority 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 the General Studies subjects. For General Studies subjects see the **General Studies 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)
- C (Credit *or* Credit units)
- CR (Credit Level)
- DN (Distinction)

	School, Department etc	Faculty	Page
	*Subjects also offered for courses in this handbook		
1	School of Physics	Science	
2	School of Chemistry*	Science	124
4	**School of Materials Science and Engineering**	**Applied Science**	**124**
5	School of Mechanical and Industrial Engineering	Engineering	
6	School of Electrical Engineering and Computer Science*	Engineering	124
7	**School of Mines (Mineral Processing and Extractive Metallurgy and Mining Engineering)**	**Applied Science**	**125**
8	School of Civil Engineering*	Engineering	128
9	**School of Fibre Science and Technology (Wool Science)**	**Applied Science**	**129**
10	School of Mathematics	Science	
11	School of Architecture	Architecture	
12	School of Psychology	Biological Sciences	
13	**School of Fibre Science and Technology (Textile Technology)**	**Applied Science**	**130**
14	School of Accountancy	Commerce	
15	School of Economics	Commerce	
16	School of Health Administration	Professional Studies	
17	Biological Sciences	Biological Sciences	
18	School of Mechanical and Industrial Engineering (Industrial Engineering)	Engineering	
21	Department of Industrial Arts	Architecture	
23	School of Nuclear Engineering	Engineering	
25	**School of Mines (Applied Geology)**	**Applied Science**	**130**
26	Department of General Studies	Board of Studies in General Education	
27	**School of Geography**	**Applied Science**	**133**
28	School of Marketing	Commerce	
29	School of Surveying*	Engineering	135
30	Organizational Behaviour*	Commerce	136
31	School of Optometry	Science	
32	Centre for Biomedical Engineering	Engineering	
35	School of Building	Architecture	
36	School of Town Planning*	Architecture	136
37	School of Landscape Architecture	Architecture	
38	**School of Biological Technologies (Food Science and Technology)**	**Applied Science**	**137**
39	Graduate School of the Built Environment	Architecture	140
40	Professorial Board		
41	School of Biochemistry	Biological Sciences	

	School, Department etc	Faculty	Page
	*Subjects also offered for courses in this handbook		
42	**School of Biological Technologies (Biotechnology)**	**Applied Sciences**	**140**
43	School of Botany	Biological Sciences	
44	School of Microbiology	Biological Sciences	
45	School of Zoology*	Biological Sciences	142
46	**Faculty of Applied Science**	**Applied Science**	**142**
47	Faculty of Engineering (Safety Science)	Engineering	
48	**School of Chemical Engineering and Industrial Chemistry**	**Applied Science**	**142**
50	School of English	Arts	
51	School of History	Arts	
52	School of Philosophy	Arts	
53	School of Sociology	Arts	
54	School of Political Science	Arts	
55	School of Librarianship	Professional Studies	
56	School of French	Arts	
57	School of Theatre Studies	Arts	
58	School of Education	Professional Studies	
59	Department of Russian	Arts	
60	Faculty of Arts	Arts	
61	Department of Music	Arts	
62	School of History and Philosophy of Science	Arts	
63	School of Social Work	Professional Studies	
64	School of German Studies	Arts	
65	School of Spanish and Latin American Studies	Arts	
66	Subjects Available from Other Universities		
67	Faculty of Science	Science	
68	Board of Studies in Science and Mathematics	Board of Studies in Science and Mathematics	
70	School of Anatomy	Medicine	
71	School of Medicine	Medicine	
72	School of Pathology	Medicine	
73	School of Physiology and Pharmacology	Medicine	
74	School of Surgery	Medicine	
75	School of Obstetrics and Gynaecology	Medicine	
76	School of Paediatrics	Medicine	
77	School of Psychiatry	Medicine	
78	School of Medical Education	Medicine	
79	School of Community Medicine	Medicine	
80	Faculty of Medicine	Medicine	
81	Medicine/Science/Biological Sciences	Medicine	
85	Australian Graduate School of Management	AGSM	
90	Faculty of Law	Law	

Chemistry

2.251G Toxicology, Occupational and Public Health **F L1T3**

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.

2.271G Chemistry and Analysis of Foods **F L1T3**

Illustrates the bases and application of analytical techniques as applied to foods. Emphasis is placed on the design of methods, on the preparation of material for instrumental analysis and on the interpretation of data. Includes: proteins and flesh foods, carbohydrates and saccharine foods, fats and oils, dairy and fermentation products, vitamins, food additives — preservatives and colouring matters, pesticide residues, metal contaminants — food microscopy.

Materials Science and Engineering

4.201G Graduate Materials Seminar **F L1T1**

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.

4.211G Metallurgical Practice **S1 or S2**

Studies relating to one or more specialised areas such as founding, welding, corrosion.

4.221G 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.

4.231G Advanced Theoretical Metallurgy **S1 or S2**

Topics drawn from physical, chemical and mechanical metallurgy.

4.241G Graduate Materials Project **F6**

An experimental, technical investigation or design project, including a written thesis.

4.251G 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.

Electrical Engineering and Computer Science

Graduate Study

6.070G Digital Image Processing Systems **C3**

Excluded: 6.467G.

The fundamentals of image processing. Visual perception and the image model, transforms, enhancement, sharpening and smooting, restoration, encoding, segmentation, reconstruction of images from projections and tomography, satellite imaging and imaging in remote sensing; image processing hardware and systems; picture processing; measurement and inspection.

6.468G Computer Display Systems and Interactive Instrumentation **C3**

Prerequisite: 6.060G.

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.

6.580G Image Analysis in Remote Sensing **C3**

Prerequisite: 10.361 or similar.

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.

6.581G 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.

6.587G Computer Techniques in Remote Sensing Image Analysis C3

Prerequisite: 6.580G or similar.

A detailed treatment of computer methods for implementing analytical techniques used with remotely sensed data. *Topics include:* software requirements for image enhancement and analysis; structure and capabilities of the software packages LARSYS, ORSER, BICEP, A2 ASP (R-stream); implementation of classification methodologies, introduction to image processing hardware and associated operating systems; interactive image processing.

Mining Engineering and Mineral Processing and Extractive Metallurgy

Mining Engineering and Mineral Processing and Extractive Metallurgy are Departments within the School of Mines.

Generally these subjects are of three hours' duration per week or multiples of that time.

7.001G Exploratory Drilling and Development

Drilling equipment and technology. Deep boring. Selection of drilling methods, drill hole surveys. Development and exploitation of mineral resources. Exercises on mine planning.

7.111G 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.

7.122G 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.

7.132G 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.

7.151G 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 workability of rocks; fracturing. Nature, occurrence and prediction of rockbursts. Mechanics of crack propagation and subsidence.

7.152G 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.

7.153G 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.

7.154G 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.

7.311G Mineral Beneficiation

Prerequisite: 7.7341.

Processing economics: mineral processing and its integration with mining, metallurgical and chemical operations. Principles of roasting, leaching, electrolysis, cementation, solvent extraction and ion exchange. Particle mechanics size, shape, surface area, size distribution functions. Relative and bulk densities. Theory of fracture mechanisms, comminution, energy requirements. Processes of agglomeration. Physical separation methods, electronic sorting, electrostatic and magnetic separation.

7.322G Mineral Beneficiation Technology

Prerequisite: 7.311G.

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.

7.332G Mineral Engineering Laboratory

Prerequisite: 7.311G.

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.

7.351G Mineral Beneficiation

Prerequisite: 7.7342 or 7.311G.

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.

7.361G 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-, Surface- and Volume mean sizes. **5.** Interfacial phenomena: Free surface energy. Surface tension. Three phase contact. Electrokinetic theory. Double layer interaction. Chemical and physical adsorption. Experimental techniques. Foams.

7.362G 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.

7.363G Minerals Engineering Laboratory S1 T3

A series of laboratory investigations relating to material covered in subjects 7.361G and 7.362G.

7.364G 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.

7.365G 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.

7.442G 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.

7.455X Mining Geomechanics Project **F 4**

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.

7.515X Rock Mechanics Measurements **F 3**

Field measurement of rock mass properties. Controlled post-failure strength and deformation properties of rock. Data collection and analysis. *In situ* stress measurement. Prediction of pre-mining rock stresses. Monitoring rock movement and stress change in underground and surface rock excavations. Seismic techniques in rock mechanics.

7.525X 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.

7.535X Mine Fill Technology **F 2**

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.

7.545X Advanced Rock Cutting Technology **F 2**

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.

7.555X Blasting Technology **F 2**

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.

7.565X 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.

7.575X Subsidence Engineering **F 2**

Trough subsidence resulting from the extraction of bedded mineral deposits. Parameters influencing subsidence. Subsidence-related phenomena causing damage to structures at or below the surface. Measurement and empirical prediction. Theories and modelling of subsidence. Control of subsidence.

7.585X Economics and Management of Geomechanics Projects **F 2**

Principles of historical accounting. Cash flow determination and cost-benefit analysis of geomechanics projects. Time value of money, discounted cash flow and incremental analysis and the effects of leverage, inflation and cost of capital. The use of sensitivity and probability analysis and optimization of economic benefit by dynamic and linear programming.

7.916G 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.

7.917G 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.

7.926G Practical Aspects of Air Pollution Measurement and Control **S1 or S2 T3**

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.

7.936G 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 lnE/pH, potential/pH, temperature/pH and concentration/pH are developed as an aid to assessing system energetics. Sources and estimation of thermodynamic data. Kinetics and mechanism in relation to aqueous system energetics. Analysis of kinetic data.

Civil Engineering

8.402G 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.

8.403G Theory of Land Use/Transport Interaction **S1 C3**

Theoretical aspects of land use transport planning. Basic concepts, data collection methods, systems models and equation of state (functional behavioural, optimizing). Introduction to land use-transport modelling (land use, generation, distribution, modal assignment, network assignment, evaluation). Planning methodologies (short-, medium-, long-term; action planning, strategic planning; local, urban, regional, national).

8.413G Transport Economics **S2 C3**

Cost and price analysis fo each of the transport modes (road, rail, air and sea). Welfare analysis and taxation theory with respect to transport. Economics of location, economics of land use models; regional trade model.

8.701G Economic Decision Making in Civil Engineering **SS C3**

Review of practical engineering decision-making problems and relevant techniques. Engineering economics, benefit/cost analysis, consideration of inflation and taxation in investment decisions, bidding, decision theory, microeconomic theory, objectives and criteria, multiple objective planning.

8.703G Optimization Techniques in Civil Engineering **SS C3**

Search, linear programming, non-linear programming, geometric programming, calculus of variations, maximum principle, applications.

8.776G Rock Mechanics **SS C3**

Strength and deformation characteristics of rock mass and joints; flow through joints and porous rock; failure criteria; stresses and deformations around underground openings; tunnel lining and rock anchors; stability of rock slopes; stabilization of rock slopes; stability of underground excavations related to mining; foundations of dams in fissured and layered rocks.

8.777G Numerical Methods in Geomechanics **SS C3**

Fundamentals of finite element and boundary element methods; deformation and flow problems; linear and non-linear analysis; applications to underground opening, stability of slopes, foundations, mining excavation; seepage and consolidation; soil-structure interaction problems; earth pressures, retaining walls and buried pipes; thermal stress analysis.

8.778G Geotechnical Processes for Energy Resources **SS C3**

Principles of rock fragmentation: blasting patterns; prediction and estimation of ground vibrations; damage criteria; numerical techniques for the prediction of rock fracture; grouting materials and techniques.

8.833G Free Surface Flow **SS C3**

Theory of waterflow in open channels. Application of theory to design of hydraulic structures, spillways, control gates, energy dissipators, channel transitions. Use of hydraulic models.

8.837G Hydrological Processes **SS C3**

Hydrologic cycle, water and energy balances, atmospheric moisture, precipitation process, evaporation and transpiration, storm runoff process, land use and management, stream gauging, instruments.

8.838G Flood Design **SS C3**

Excluded: 8.846G.

Introduction to flood estimation, design rainfall data, hydrograph analysis, storm runoff, loss rates, rational method, unit hydrographs, introduction to urban drainage design, flood frequency.

8.839G Advanced Flood Estimation **SS C3**

Flood routing, catchment characteristics, runoff routing, synthetic unit hydrographs, urban runoff, regional empirical flood estimation methods, advanced unit hydrograph theory.

8.842G 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.

8.843G Groundwater Hydraulics **SS C3**

Mechanics of flow in saturated porous materials, steady and unsteady flow to wells, leaky aquifers, partial penetration, multiple aquifer boundaries, delayed yield from storage, regional studies.

8.847G Water Resources Policy **SS C3**

Resource economics, water supply, water demand, multiple objective planning, multiple purpose projects, water law, water administration, case studies.

8.848G Water Resource System Design **SS C3**

Principles of the optimal design and operation of multiple purpose, multiple component, water resource systems; evaluation of cost and benefits in complex and simple systems.

8.849G Irrigation **SS C3**

Soils, soil-water relationships, plants, climate, crop requirements; water budgets, sources, quality, measurement; irrigation efficiency. Design of irrigation systems, appurtenant works, distribution.

8.850G Drainage of Agricultural Land **SS C3**

Characteristics of drainage systems, steady and unsteady state drainage formulae, conformal transformation solutions, soil characteristics field measurement of hydraulic conductivity and soil water pressure, significance of unsaturated zone, practical aspects.

8.860G Investigation of Groundwater Resources 1 **SS C3**

Occurrence and extraction of groundwater, investigation and drilling methods, systems approach, optimization techniques, conjunctive use studies, quality of groundwater.

8.861G Investigation of Groundwater Resources 2 **SS C3**

Geophysical methods, remote sensing, photo-interpretation, arid-environment studies, analog models, case studies.

8.864G Arid Zone Hydrology **S1 L1½T1½ C3**

Co-requisite: 8.837G, 8.838G.

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.

8.865G Arid Zone Water Resources Management **SS L1½T1½ 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 works, 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.

Wool Science

Wool Science is a Department within the School of Fibre Science and Technology.

9.105G Livestock Production **F L2 T4**

Biology of reproduction and reproductive performance of sheep and cattle; growth and body composition; meat production and quality.

9.205G 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.

9.424G Minerals and Their Effects on Grazing Animals **C2**

The importance of minerals for mammals. The nutritional significance of the important elements and the effect of ingestion, inhalation, or absorption or excessive amounts of these elements will be discussed. Emphasis on grazing sheep and cattle, but with other examples where appropriate.

9.504G 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.

9.803G 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.

9.813G Quantitative Methods **F L2 T2**

Selected topics in: biostatistics and economic statistics, with emphasis on experimental design and on least squares procedures; response surface estimation and analysis; mathematical programming methods for rural industries; data processing and computer programming; systems analysis and simulation methods.

Textile Technology

Textile Technology is a Department within the School of Fibre Science and Technology.

13.701G Fibre Science **S1 L2**

Chemical constitution and reactivity of natural and man made fibres, molecular and morphological structure of textile fibres. Production of textile fibres, addition and condensation polymerization, polymerization kinetics, molecular weights of polymers and copolymers, crystallinity and orientation of polymers. Relationships between molecular structure and mechanical properties of fibres.

14.702G Textile Testing and Quality Assurance **F L1T2**

Statistical basis of sampling for textile testing and quality control and assurance. Identification and selecting of textile and raw materials. Measurement of yarn properties and of intermediate products which affect yarn quality (linear density, twist, irregularity). Properties of woven, knitted and non-woven fabrics and their measurement (mechanical properties, serviceability, etc). Measurement of consumer oriented properties (colourfastness, dimensional stability, seaming etc). Modification and performance testing. Care-labelling and associated test requirements.

13.703G Yarn Technology **S1 L4T2**

Technical requirements of textile yarns, structural analysis of staple fibre and continuous filament yarns. Principles of yarn forming processes for long and short staple fibres (fibre cleaning, blending, carding, combing, drawing, spinning, twisting, winding) with particular reference to cotton and wool processing systems; man-made staple fibre processing, production and texturing of continuous filament yarns, unconventional techniques of yarn forming. Introduction to yarn mechanics.

13.704G Fabric Technology **S2 L4T2**

Objectives of fabric technology; historical development; structure of the industry; range of fabric types and end-use applications (clothing, furnishings, industrial fabrics). Principles and practice of fabric-forming technology: weaving, knitting and other methods (melt-bonded, needle-punched and resin-bonded nonwovens); elements of fabric design and construction; introduction to clothing technology; recent developments and research, microprocessor and computer applications. Evaluation of fabric performance criteria: physical and mechanical properties; introduction to fabric mechanics; recent developments and research, introduction to objective measurement technology.

13.705G Finishing Technology **S2 L4T2**

Objects of finishing and typical flow diagrams. Principles and technology of textile finishing processes: removal of impurities and discolouration, elimination or minimization of deficiencies in the properties of textile fibres, development of specific properties; production of specified dimensions in textile fabrics, mechanical processes, surface finishes, protective finishes, detergency, properties of surfactant solutions, micelle formation, emulsification. Chemistry of application of specialized finishes such as flameproof finishes, crease-resistant finishes. Recent developments in finishing technology.

13.706G Dyeing Technology **S1 L4T2**

Computer aided colour matching. Measurement and specification of colour and aspects of colour such as colour mixing and colour vision. Classification of dyes and their methods of application, general properties of dyes, dyeing auxiliaries and after-treatment. Mill water supplies and their treatment, dyehouse effluent treatment. Textile printing methods. Dyestuff aggregation and its measurement. Influence of fibre structure on dye uptake. Effects of thermal and mechanical history of fibres on dye uptake. Physical-chemistry concepts in dyeing including dyeing equilibria, dyeing kinetics, steady state and non-steady state diffusion processes. Textile dyeing machinery. Recent developments in dyeing technology.

13.901G Dissertation **FT2**

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 school, and submitted in written form.

Applied Geology

25.702G Hydrogeology **S1 L1½T1½**

Surface and sub-surface methods of geological and geophysical investigation; ground water exploration of confined and unconfined aquifers. 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.

25.703G Project (Engineering Geology Graduate Course) **S2**

The project is a research investigation consisting of field and laboratory work in any of the disciplines. Engineering Geology, Hydrogeology, Environmental Geology.

25.704G Environmental Geology **S1 L1½T1½ 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.

25.705G Engineering Geophysics **S1 L2T1**

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.

25.706G Geological Basis of Geomechanics **S1 L2T1**

Geomechanical behaviour of soils. Stress-strain theories, elasticity and plasticity. Clay-water reactions and their relation to soil behaviour. Laboratory and field investigation techniques, including CBR, Proctor, field penetrometer, triaxial compression. Engineering classification of soils and soil stabilization. Elasticity and strength properties of rocks, state of stress in virgin rock masses, residual tectonic stresses, stresses about rock openings and beneath point loads. Mechanical classification of rocks. Rock mechanics testing procedures.

25.707G Geopollution Management **S1 L1½T1½ 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.

25.708G Engineering Geology **S1 L2T1**

Co-requisite: 25.706G.

Soil and rock slope stability analyses and stabilization methods: geological, geomorphic and engineering considerations. Construction materials exploration, evaluation and assessment of standards, concrete aggregate requirements, tests. Practical site investigation procedures: drill core logging, RQD, drilling programs. Engineering classifications of weathered rocks. Weathering and engineering works. Discontinuities in rock masses, analysis, influence on engineering properties. Soil fabric analysis; principles and application to engineering behaviour of soil masses. Engineering geology organization; contracts; critical path analysis and geological investigations; communication between geologists and engineers. *Field tutorials:* Several field tutorials are included.

25.710G Coastal Environmental Geology **S1 L1½T1½ C3**

The shoreline processes; calculation of beach profiles and littoral drift. Longshore drift and net sand movement. Coastal protection: groins, beach nourishment. Foundations of coastal engineering works. The estuarine environment: sedimentation, chemical and biological processes in estuaries. Man's impact on the water environment. Investigation techniques. Marine hydraulic works: sewage disposal, thermal pollution.

25.711G Arid Zone Engineering Geology **S1 L2T1 C3**

Geological characteristics of arid zones. Weathering of rocks and soil development under arid conditions. Engineering properties of weathered rocks and soils. Hydrogeology of arid zones. Engineering geology of water storages and traffic routes. Construction materials. Planning engineering geology and hydrogeology investigations with inadequate data. Includes a field exercise at Fowler's Gap Arid zone Research Station of at least 3 days duration.

25.712G Project in Terrain Management **S2 T9** C9**

A practical exercise to illustrate the application of engineering geology in terrain evaluation and management, to be carried out at Fowlers Gap Research Station. A report is required.

25.713G Research Project in Terrain Management **F T9** C18**

A substantial research project involving the application of engineering geology in terrain evaluation and management. Involves fieldwork at Fowlers Gap Research Station. A report is required.

25.714G Geology of Foundations **S1 L2T1**

A detailed review of case histories of the geological factors influencing the foundations of dams, buildings, bridges, roads and airfields. The geology of large underground cavities. Methods of geological investigation.

25.800G 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.

25.801G 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.

**Equivalent contact hours, but also including fieldwork out of session.
*Weeks 1-7 only.

25.802G 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.

25.803G 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.

25.804G 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.

25.805G 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.

25.807G Exploration Geophysics **S1* L6**

An introduction to the theory and practices 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 radio-metric 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.

25.808G Exploration Project **S1* T6**

Interpretation of exploration case-history data designed to familiarize students with the type of information normally required by exploration companies.

25.811G Advanced Geology in Exploration **S1† L4**

Definition of the geological environment and search techniques for major categories of mineral deposits including porphyry coppers, carbonate- and shale-hosted lead-zinc ores, volcanogenic massive sulphide ores, vein and sandstone uranium. Geological aspects of reserve estimation. Exploration case histories.

†Weeks 8-14 only.

25.815G 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.

25.816G 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 linking 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.

25.817G 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.

25.818G Exploration Project **S1† T6**

Design and costing of exploration program by students. This may be based on simulated conditions or actual situations.

25.819G 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.

25.821G Geology in Exploration 2 **S1† L2**

Specialized search techniques for selected types of metallic ores, with appropriate case histories.

25.823G Advanced Exploration Geochemistry **S1† L2T6**

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.

25.824G Advanced Data Processing and Interpretation **S1† L2T2**

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.

25.827G Laboratory Methods S1† L1T3

Instruction in the main techniques of sample preparation and instrumental analysis appropriate to exploration geochemistry. Practical experience with AAS and XRF. Students are encouraged to supply their own samples.

25.828G 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.

25.829G 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.

25.831G 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.

25.832G Advanced Exploration Geophysics S1† L16

An extension of, and considerable 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 applications 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.

25.839G 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/geochemistry exploration.

25.840G 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.

25.915G Project in Hydrogeology

Small project involving the analysis of hydrogeological data from Fowlers Gap.

25.916G Research Project in Hydrogeology

Research project on some aspect of the hydrogeology of an arid region.

†Weeks 8-14 only.

Geography

27.043G Remote Sensing Applications S1 L1T2 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.

27.171G Directed Problems in Remote Sensing S2 L1½T1½ C3

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

27.174G Remote Sensing Instrumentation and Satellite Programs S1 L2T1 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, Geodynamics Experimental Ocean Satellite, NOAA-9, Nimbus Coastal Zone Color Scanner, Seasat, Space Shuttle, Spot and Soyuz-Salyut.

27.202G Environmental Planning and Evaluation C3

Lectures and seminars on environmentalism and political economy, environmental information, impact assessment, and economic evaluation.

27.644G 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 for cartographic manipulation and output.

27.672G 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 for spatial data manipulation and display.

27.902G Meteorological and Hydrological Principles **S2 L3 C3**

1. *Meteorology:* Heat and water balances of earth-atmosphere system. Global pressure, wind and climatic patterns. Atmospheric stability, temperature inversions, aerological diagrams. Synoptic and local wind systems, dispersal of atmospheric pollutants under various conditions of stability and wind. Precipitation and precipitation fallout. Weather forecasting with particular reference to forecasting pollution potential. **2.** *Hydrology:* Catchment morphology. Precipitation: streamflow relationships; frequency analyses in hydrology. Drought and low flow analyses. Channel morphology and stream velocity characteristics, tidal estuaries, ocean currents. Dispersal of pollutants in flowing water.

27.910G Geomorphology of Arid Lands **S2 L2T4 C6**

Physiographic, 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 photo-interpretation of desert landforms and in related geomorphic mapping.

27.911G Soil Erosion and Conservation **S1 or S2 L2T4 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 management practices. Methods of assessing soil loss risk and erosion hazard evaluation.

27.912G Arid Zone Climatology **S1 L2T4 C6**

Definitions of aridity based on climatic data and their relevance at different scales from hydrologic and biologic considerations. Measures of precipitation effectiveness. Meteorological controls of aridity at global and regional scales, and distinctive features of arid climates over the world. Characteristics and physical controls of the radiation, water and heat budgets as commonly found within arid environments. Climate as a fact in resource utilization considered in terms of plant growth and development, animal ecology, insects and diseases, soil erosion, and human adjustments to arid conditions, including problems of comfort, health, buildings design and energy use. *Laboratory and field work* is directed towards **1.** instrumentation and measurements of climatic variables of special interest in arid environments, particularly those important to the radiation, water, and heat budgets; and **2.** statistical and other quantitative methods for summarization and interpretation of single and combined climatic elements to provide relevant information required for sound management of arid lands.

27.913G Soil Studies for Arid Lands Management **S1 or S2 L2T4 C6**

Soil forming processes in arid regions. Physical, mineralogical and chemical characteristics of arid soils, with emphasis on properties significant for land capability. Chemical and physical properties of saline and alkaline soils. Soil response to irrigation, secondary salinization and 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 27.133 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.

27.914G Terrain Evaluation **S1 L2T4 C6**

Methods of defining and mapping land units for resource assessment and management. Principles of land capability classification with reference to pastoral, agricultural and irrigation land use in arid and semi-arid regions. Physical indicators of desertification and land degradation in dry regions including accelerated wind and water erosion and secondary salinization.

27.922G Applied Geomorphology **S2 L1½T1½ 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. Geomorphology in predictive modelling of basin hydrological response and in water resource assessment. Exercises in airphoto and map analysis of fluvial landforms or terrain types. Field excursion on fluvial landform or terrain assessment, as required.

27.923G 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.

27.950G Project **S2 T9 C9**

A practical application or investigation 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 Folwers 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.

27.951G Research Project **F2 T9 C9**

As for 27.950G Project, but involving more substantial research over a longer period. Tutorial hours are equivalent contact hours, but also involve fieldwork out of session.

Surveying

29.101G Aspects of Electromagnetic Distance Measurement **SS L2T1 C3**

New developments in electronic distance measurements including multiple wavelength systems, interferometers, optical transponders. Component properties of instrumental errors. Techniques of instrumental calibration and establishment of calibration facilities. High precision measurement techniques.

29.102G Characteristics of Optical Surveying Instrumentation **SS L2T1 C3**

Sources of error in modern optical surveying instruments. Methods of testing and calibration. Observational techniques for reducing effects of errors. Developments in circle reading and level sensing systems. Design of instrument testing facilities.

29.103G Precise Engineering Surveys **SS L2T1 C3**

Techniques and instrumentation for precise surveys. Applications in industry and engineering; deformation and settlement surveys, surveys for large constructions, optical tooling, special measurement problems.

29.106G Special Topic in Surveying A **C3**

A special subject to be lectured on by visiting professors or other visiting staff. Details of syllabus and lecturer to be communicated to the Higher Degree Committee on each occasion when the subject runs.

29.107G 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.

29.151G Adjustment of Control Surveys **SS L2T1 C3**

Choice and analysis of adjustment models in geodetic triangulation and control surveys. Detection of outliers. Design optimization and analysis of survey control networks. Methods of carrying out very large continental adjustments.

29.210G Satellite Surveying **SS L2T1 C3**

Concepts of satellite surveying: nomenclature, TRANSIT system, GPS for point and relative positioning, vertical control. Surveying with GPS: planning a survey, field and office procedures, case studies. Considerations for high-precision applications: aspects of satellite geodesy, modelling the observable, dual frequency observations, orbit determination, short-arc techniques.

29.212G Doppler Positioning **SS L2T1 C3**

Description of the TRANSIT system of satellites. Principle of Doppler measurements. Geodetic position from Doppler. Doppler satellite receivers, computation of point position and translocation using on-board software. Broadcast and precise ephemerides. Mainframe software and mutli-station computation. Interpretation of results.

29.217G Gravimetric Geoid Evaluations **SS L2T1 C3**

Introduction to the representation of the earth's gravity field Physical model for the earth. Geodetic boundary value problem. Techniques, for evaluating Stokes' integrals. Relative geoid determinations. Combination techniques.

29.530G Analytical Photogrammetry **SS L2T1 C3**

Fundamental relationships, image and object space. Interior orientation, deviations from collinearity, use of reseau. General orientation of one and two images by collinearity and coplanarity conditions. Calibration of metric and non-metric cameras. Principles of analytical plotters, software design. Special applications of photogrammetry.

29.531G Photogrammetric Block Adjustment **SS L2T1 C3**

Review of strip triangulation. Simultaneous block adjustments with independent models and bundles. Additional parameters. Solution of large systems of symmetric strongly diagonal linear equations. Computer programs. Control requirements and auxiliary control.

29.532G Computer-Assisted Mapping **SS L2T1**

Introduction to principles of computer-assisted mapping. Sources of data, ground survey maps, images. Collection and editing of feature coded digital terrain data, points, lines and areas. Digital elevation models, acquisition and interpolation, breaklines, contouring. Accuracy of heights from digital elevation models. Design of mapping programs based on computer-assisted techniques.

29.600G Principles of Remote Sensing **S1 L2T1 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.

29.601G Remote Sensing Principles and Procedures **S1 L2T1 and S2 L1½T1½ C6**

Electromagnetic radiation. Definition and physics of basic quantities. Photographic film, images and sensors. Electro-optical sensors. Data systems. Examples of operational systems. Positioning, preprocessing, deconvolution, enhancement and classification theory and application to Landsat data. Project involving processing of Landsat data.

29.603G Statutory Controls of Land Development **SS L2T1 C3**

Detailed examination of the subdivision and development process in N.S.W., with particular emphasis on the statutory procedures and controls at the local government level. The Local Government Appeals Tribunal and its major relevant decisions. Local Government and land development law. Case studies in land development.

29.604G Land Information Systems **SS L2T1 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.

29.605G Ground Investigations for Remote Sensing **S1 L2T1 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.

29.608G Cadastral Systems **SS L2T1 C3**

The cadastral concept. Cadastral surveying and mapping, land registration, valuation of land, land tenure and land administration. Cadastres and land information systems (L.I.S.). Strategies for improving cadastral systems. Cadastral systems in developing countries; legal, technical, administrative, economic and social issues.

29.909G Project **C9**

29.918G Project Report **C18**

29.936G Thesis **C36**

Organizational Behaviour

Due to uncertainties in staffing, it is not possible for the Faculty of Commerce to give an assurance that all subjects in Organizational Behaviour listed in the handbook will be offered in future years.

30.935G Organization Behaviour **S1 L3**

Prerequisite: Nil.

Relationships between individuals and organizations. Individual behaviour—personality, perception, motivation, learning, performance. Organizations as settings for individual behaviour—types of organization, work organizations. Interaction, groups and work groups. Organizational influences on work behaviour: structural factors and the design of work; reward systems; organizational cultures and social influences. The development of individual-organization relationships: participation, socialization, careers; conflict, stress and adaptation; organizational effectiveness.

30.958G Organizational Communications **S2 L3**

Prerequisite: 30.935G.

Communication is both an end and a means to an end for members of complex organizations. As an end, the patterned inputting, processing and outputting of information is the network of interdependent relationships that we come to call an organization. Thus communication is organizing. As a means to an end, communication suggests the ways that govern the interaction of organizational members exchanging messages in service of such outcomes as decision making, innovation, etc. Organizational communication therefore is the study of the *flow* of messages in an information network as well as the *uses* made of those messages by network participants for the overall attainment of organizational goals.

30.960G Technological Change and Organizational Participation **S1 and S2 L3**

Prerequisite: 30.942G or 14.956G.

The complex relationships between technological change and organizational participation in societies using advanced technology, with particular reference to Australia, California, Japan, Germany and the Nordic nations. Key issues include: the relationship between technological change and sociotechnical systems, skill formation, organizational learning, industrial relations, humanization of work, organizational equity, participation, and power.

Town Planning

Graduate Study

36.945G 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.

Food Science and Technology

Food Science and Technology is a Department within the School of Biological Technologies.

38.151G 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.

38.152G Food Process Laboratory — S2 T6

Co- or prerequisites: 38.164G, 38.165G, 38.166G, 38.350G.

An integrated series of laboratory and pilot plant exercises illustrating the principles and procedures involved in processing and examination of foods.

38.153G Food Technology 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.

38.155G Dairy Technology — L1T1

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.

38.156G Oenology — S1 L2

Co- or prerequisite: 38.165G.

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.

38.157G Technology of Cereal Products — S1 L2

Prerequisite: 38.132 or 38.165G.

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.

38.158G Marine Products — S1 L2

Prerequisite: 38.133 or 38.166G.

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

38.161G Food Additives and Toxicology — S2 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.

38.162G Postharvest Physiology and Handling of Fruit and Vegetables — S1 L1T5

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

38.164G Elements of Food Preservation — S1 L4T1

Introduction to food preservation and spoilage, food wastage. Technology of food preservation by heat, cold, sun-drying and dehydration. Use of sugar, salt, acid, chemical preservatives, ionizing radiations. Chemical and microbial stability of preserved foods. Water relations of foods. Food packaging requirements, shelf-life prediction. Nutritional consequences of food processing.

38.165G Plant Food Products **S1 L3**

Fruits and vegetables: significance in world nutrition, trade; harvest, post-harvest deterioration and control; aspects of development, maturation, ripening; technology of juice, wine production, assessment procedures. *Cereals:* structure, composition, uses; wheat, rice milling; baking technology. *Sugars:* sources, types, composition, milling, refining; function in foods. *Lipids:* isolation, purification, chemistry, processing for frying, spreads, shortening, other food uses. *Proteins:* sources, extraction, texturizing, processing; nutritional and toxicological considerations. Pest control.

38.166G Animal Food Products **S2 L2**

Meat: technology and biochemistry of meat production, composition and quality, preservation and microbiology. *Marine products:* types, distribution, harvesting, microbiology, autolytic and chemical changes; measurement and control of spoilage, use of microbiological and chemical methods, low temperature, drying. *Eggs:* production, preservation, structure, composition, microbiology; functional properties of components; egg quality; freezing and drying processes. *Dairy products:* chemical and physical properties of milk and their manipulation during processing and production of milk, cheese, butter and ice-cream.

38.350G Food Microbiology **S1 L3T1**

Microbiological examination of foods: sampling methods, plans, specifications, standards; enumeration, rapid methods; sub-lethal injury. *Food spoilage:* ecology, associations, dominant species; biochemistry, physiology of growth, enzyme production; off-flavours, odours and slimes. *Food fermentations:* ecology and biochemistry; fermented milks, vegetable, meat, cereal and marine products; Asian fermented foods; yeast and autolysates; single cell protein. *Food-borne microbial disease:* foods as vectors of disease, food poisoning; incidence, occurrence of infection and intoxication; ecology and taxonomy of common bacterial pathogens; food-borne viral disease; mycotoxins; methods of detection and enumeration of pathogens, indicator organisms; control and prevention of food-borne disease, standards, legislation, food hygiene.

38.351G The Microbial Ecology of Foods **S2 L2T4**

Prerequisites: an introductory subject in microbiology, 38.350G or 38.331.

An integrated lecture and laboratory course covering the ecology, taxonomy and biochemistry of bacteria, yeasts, fungi and viruses involved in food spoilage, food-borne disease and food fermentations. Emphasis on specific methodologies for the detection, enumeration and identification of food associated bacteria, yeasts and fungi. Problems of enumerating microorganisms in foods: techniques of food sampling; formulation, performance and evaluation of selective-differential media; sub-lethal injury; indicator organisms. Rapid methods for microbial enumeration and identification. Control of microorganisms in foods; microbiological quality control, food legislation, microbiological criteria.

38.451G Advanced Food Engineering **S1 L2T1**

Prerequisites: 38.421 and 38.432 or an introductory subject in material and energy balances, heat transfer and fluid mechanics.

Mathematical representation using vector calculus of heat and mass transfer and fluid mechanics in foods; numerical methods of solution; thermodynamic analysis of processes; laboratory work on the thermophysical properties of foods.

38.452G Drying of Foods **S2 L2T1**

Prerequisite: 38.451G.

Psychrometry; water activity of foods; transport in porous media; spray drying, fluidized bed drying, freeze drying, batch and continuous drying; drying of grain in bulk silos; solar drying of fruit and vegetables.

38.551G Advanced Nutrition **S2 L2T1**

Prerequisite: 38.553G.

Detailed treatment of the role of the nutrients in health and disease at different stages of the human life cycle. Nutritional topics of particular relevance to developing countries including population, infection, rehabilitation, productivity, education.

38.552G Methods of Nutritional Assessment and Analysis **S2 L1T5**

Co- or prerequisite: 2.271G.

Nutrient assay of foods including bench and instrumental techniques. Human nutritional assessment by anthropometric, dietary and biochemical methods.

38.553G Principles of Nutrition **S1 L2T2**

Co- or prerequisite: 42.212G or an introductory subject in Biochemistry.

The role of the nutrients in human structure and function, including nutritional imbalance states. Includes simple anthropometry and dietary intake study.

38.700G Master of Applied Science Major Project (Food Engineering) **S2 T8**

Individual research project involving a literature survey, and an experimental research program of relevance to the needs of the candidate's home country. A detailed thesis embodying the literature survey, the experimental investigation, the results and discussion of results, and proposals for further investigations.

38.701G Man's Food **S1 L1**

Foods of developing and developed countries; world food production and trade; world food agencies; food development programs. Food habits, attitudes and beliefs; sensory perception; food choice.

38.702G Food Engineering A **S1 L2T2**

Introduction to engineering principles: dimensions and units, dimensional analysis. Sources of physical data for foods. Material balances and systematic methods of solution. Thermodynamic diagrams. Thermal energy balances. Rheology of fluid foods. Mechanical energy balances. Design calculations for pipes and pumps. Measurement and control of fluid pressure and flow. Special problems in handling fluid foods.

38.703G Food Engineering B **S1 L2T1**

Heat transfer. Steady state analysis of conductive and convective heat transfer in one and two dimensions. Methods of solution of unsteady state problems. Heat transfer equipment. Special heat transfer problems in food processing.

38.704G Food Chemistry and Enzymology **S1 L2T1**

Chemistry and function of carbohydrates, proteins, lipids, vitamins, minerals and pigments; non-enzymic browning reactions and autoxidation; effects of food processing on the functional properties of food components. *Characteristics of enzymes:* factors affecting enzyme action; the hydrolases and oxidoreductases; respiration, glycolysis, autolysis, enzymic browning and fat decomposition.

Basic laboratory techniques for the analysis of food components.

38.705G Introductory Food Microbiology **S1 L1T1**

An integrated lecture and laboratory program providing an introduction to food microbiology: microorganisms associated with food; factors affecting microbial growth and survival; enumeration of microorganisms in foods; microbial food spoilage; food-borne microbial disease and food hygiene; food fermentations.

38.706G Food Storage and Preservation **S1 L2**

Food wastage: dimensions, mechanisms and strategies for control. *Food spoilage:* mechanisms of spoilage of fresh and processed foods; principles of control. Fresh plant and animal produce storage. Traditional and modern techniques of food preservation by heat, cold, drying and dehydration; use of sugar, salt and chemical preservatives; food irradiation, chemical and microbial stability of preserved foods. Food packaging.

38.707G Reading Assignment **S1 T1**

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

38.708G Food Engineering C **S2 L2T2**

Vapour compression and adsorption refrigeration. Liquid-liquid and liquid-solid extraction. Measurement and control of process variables. Use of computer packages for statistics and other calculations. Study of local food processing plants (includes factory visits).

38.709G Technology of Food Drying **S2 L2T1**

Psychrometry. Derivation and application of psychrometric equations for air-water system. 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.

38.710G Science and Technology of Animal Products **S2 L3**

Meat and meat products: livestock resources; slaughter, muscle structure, composition and post-mortem changes; meat microbiology; ambient storage and distribution, cold storage, chilling, freezing, drying, curing and smoking, packaging. *Egg and egg products:* production; egg structure, composition, quality and microbiology; storage and preservation of shell eggs; egg pulping, pasteurization, freezing and dehydration. *Milk and dairy products:* milk production, composition, properties, microbiology; pasteurization; homogenized, lactose hydrolysed, skim, dried and condensed milks; cream, butter, ice cream, cheese and yoghurt. *Marine products:* marine and freshwater resources; harvesting and post-harvest handling; spoilage, control and assessment; chilling, freezing, salting, drying, smoking and fermentation; fish meals and protein concentrates.

38.711G Science and Technology of Plant Products **S2 L3**

Classification, structure, composition, production and trade of world plant foods. Traditional and modern practices of post-harvest handling, storage and processing of grains, pulses, fruits, vegetables, nuts, oilseeds, tubers and spices. Use of plant food products and plant-derived products. Causes of post-harvest wastage and deterioration and their control.

38.712G Food Engineering Laboratory **S2 T3**

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

38.713G Human Nutrition **S2 L1**

Introduction to the anatomy and physiology of digestion, absorption, metabolism and excretion. Food components and human nutrition; nutrient requirements and functions. Foodstuffs and nutrition. *Nutritional problems of developing countries:* undernutrition, malabsorption and natural toxicants in food; strategies for control; public health aspects, supplementation, dietary modification and fortification. Effects of food preparation and processing on nutrients.

38.714G Literature Survey **S2 T1**

Students undertake a comprehensive review of the literature as a preliminary to their major project.

38.715G Food Engineering Field Work **S1 T3**

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

38.900G Master of Applied Science Major Project **F T6**

38.901G Master of Applied Science Minor Project **F T3**

38.902G Reading Assignment **S2 T3**

Special reading assignments are set and examined by the Department of Food Science and Technology.

Graduate School of the Built Environment

39.908G Community Noise Control **S1 L1T1 C2**

Introduction; sound and sound propagation; sound power, sound pressure, decibels; sound perception, psychoacoustics; loudness, annoyance, phons and dB(A); 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 transmisson through building elements; noise components of environmental impact statements.

Biotechnology

Biotechnology is a Department within the School of Biological Technologies.

General

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

42.104G Graduate Seminars

42.111G Reading List in Biotechnology (Microbiology)

42.112G Reading List in Biotechnology (Biochemistry)

42.211G Principles of Biology **SS L3**

A study of the characteristics of living systems, including a functional treatment of cytology, metabolism, bioenergetics; structure, function and characteristics of single and multicellular systems; growth; cell division; reproduction; heredity and evolution.

42.212G Principles of Biochemistry **SS L3**

A condensed treatment of biochemistry comprising the following aspects: the elemental and molecular composition of living organisms; the chemistry and roles of the biological elements and molecules; the thermodynamics and enzymatic catalysis of metabolism; catabolic, anabolic, amphibolic and anaplerotic processes, with emphasis on hydrolysis and synthesis of polymers, glycolysis and gluconeogenesis of glucose, O-oxidation and synthesis of fatty acids, deamination and decarboxylation of amino acids, the tricarboxylic acid cycle, electron transport and oxidative phosphorylation; metabolic regulation and integration.

42.213G Biochemical Methods **SS T3**

A laboratory program in practical biochemistry. The basic instrumentation and methodology of the biochemist will be introduced by practical exercises and demonstrations. A comprehensive treatment of the relevance and applicability of biochemical techniques is covered in tutorials.

42.214G Biotechnology **SS L2T1**

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.

42.215G Practical Biotechnology **F T7**

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

42.281G Design of Microbial Reactors

Unit 1 Rate Processes

Bridging unit designed to provide the background in rate processes in heterogenous systems required for Unit 3. This unit would not be offered to a graduate with background in advanced rates processes, the equivalent of 48.0454 Reactor Engineering.

Process rates and rates of change; generalized definition of a process rate. Material balances with reaction — integral balances and balanced differential with respect to time, space, and both time and space. Measurement, interpretation and correlation of process rates. Heterogeneous systems, the influence of diffusional processes, linear and non-linear systems, lumped and distributed systems.

Unit 2 Fundamentals of Microbial Stoichiometry

This is a bridging unit offered to students with little or no background in the life sciences. A prerequiste or co-requisite would be 44.101 Introductory Microbiology or its equivalent. The unit is designed to provide an understanding of the structure of metabolism to allow the student to carry out the overall metabolic balances necessary for quantification of living systems.

Growth of an undifferentiated organism as a physico-chemical process leading to quantification of the growth processes. Overall structure of metabolic processes. Material, energy and redox balances under anaerobic and aerobic conditions. Specific metabolic rates and their quantification.

Unit 3 Design of Microbial Reactors

This unit would normally follow rate processes or fundamentals of microbial stoichiometry and is divided into two strands.

Reactor Design Fundamentals: Ideal and non-ideal reactors, residence time distribution and non-ideal reactor models. The significance of mixing and diffusion in microbial reactors for freely suspended microorganisms. The concept of a microfluid and a macrofluid and its application to the description of two-phase reacting systems — gas-liquid, oil-aqueous and solid-fluid systems will be examined with examples relevant to the biological process industries. *Microbial Reactor Calculations:* The collection, quantification and interpretation of rate data, and the design of reactors for freely suspended microorganisms; batch, semi-batch and continuous reactors; gas exchange balances. Rate processes in microbial flocs and microbial films. Design for microbial floc and film reactors.

42.282G Microbial Kinetics and Energetics

Unit 1 Microbial Kinetics

Prerequisite or co-requisite: 42.281G Unit 2 or equivalent.

Principles used in the quantification of complex systems. The quantification of biomass and the growth processes. A mechanistic approach to the quantification of microbial processes. The Monod model. Extension of the Monod model. Metabolic uncoupling. Inhibition kinetics and reactor stability. Factors affecting the substrate unlimited growth rate. The integration of metabolic control into an overall response.

Unit 2 Microbial Energetics

Prerequisite or co-requisite: 48.221G Unit 2 or equivalent.

Significance of entropy and free energy changes in microbial growth. Driven reactions, group transfer potentials, driven reaction sequences and the significance of actual and standard free energy changes in open systems. Application to metabolism, energy requiring pathways, energy producing pathways. Thermodynamic efficiency of growth. Mass, heat and entropy balances in growing cultures, prediction of yield.

42.283G Bioprocess Unit Operations and Equipment Design

Prerequisite or co-requisite: 48.284G or equivalent.

Engineering design and operating characteristics of plant and processes normally used, eg sterilization and air purification, dehydration drying at reduced pressure, reduced temperature preservation, radiation, product isolation, sedimentation, filtration, centrifugation, extraction, absorption, chromatography and ion exchange, absorption with reaction, electrophoresis and dialysis, aseptic design, materials of construction, effluent disposal.

42.284G Heat, Mass and Momentum Transport

A bridging subject designed to provide an introductory understanding of the mechanisms of transport processes. This subject would not be offered to a graduate with a background in chemical engineering principles. Mechanisms of molecular and turbulent transport. Heat, mass and momentum transport as rate processes. Boundary layer theory. Lift and drag coefficients. Introduction to non-Newtonian flow.

48.285G Bioprocess Laboratory

Practical experience in the industrial processing of biological and microbial systems. Small projects in areas of interest to the student.

42.301G Microorganism Productivity **SS L2T3**

Mechanisms of metabolic control: induction, repression and forms of activation and inhibition; microbial genetics; mutation, selection, genetic transfer and manipulation; environmental parameters; oxygen tension, pH, temperature, energy source etc. as are relevant to productivity in industrially important microorganisms.

Detailed studies: choice of substrate, screening and isolation of microorganisms, systematic application of techniques of genetic and physiological manipulation required to optimize product formation (products include amino acids, nucleotides, enzymes and other macromolecules, antibiotics and other physiologically active compounds), potential strain improvement of micro-organisms involved in other industrial processes (for example, mineral leaching, single cell protein production, detoxification and waste disposal).

Laboratory component includes current techniques of microorganism isolation and maintenance, genetic manipulation and physiological manipulation.

42.302G Enzyme Technology **SS L2T3**

Enzymes in vivo; properties; roles; sources; optimization of enzyme concentration, for example by nutritional control, environmental control and by genetic manipulation. Isolation of enzymes: methods of extraction and purification; stabilizing safeguards; assay procedures; kinetics of isolated enzymes. Immobilization of enzymes: entrapment in insoluble matrices; adsorption on high molecular weight inert carriers; ionic binding to ion-exchange materials; covalent enzyme-enzyme linkage via a low molecular weight bifunctional reagent; covalent linkage to a high molecular weight support; changes in kinetic parameters and stability after immobilization; advantages and disadvantages of immobilization. Enzyme Reactor Engineering: design of batch and continuous systems, including open and closed plug flow and stirred reactors; comparison of kinetics in various designs; scale-up. Enzyme application: analysis; fabric, food and biochemical industries; medical treatment; medical diagnosis. Occupational hazards: allergic responses to enzymes; infection from pathological samples.

Methods of isolation, immobilization and application of enzymes for analytical, industrial and medical purposes will be illustrated by laboratory exercises and short projects. Practical comparison of various reactor designs will also be made.

42.303G Biochemical Process Control **SS L2T3**

Biochemical reactors: range of basic designs; range of biocatalysts, from microbial conglomerates to free enzymes; heat and mass transfer; design; scale-up; sterility; kinetics; economic considerations. Techniques for efficient operation and control of batch, single-stage continuous and multi-stage continuous processes.

Use of computers: aids to understanding the effects of operating variables for process optimization and control. Detailed examples: microbial processes such as production of antibiotics, organic acids, amino acids and enzymes; enzymic processes.

Practical illustration of: sample processes such as yeast and antibiotic production; mathematical simulation by analog computation; computer control of biochemical processes.

42.304G Biodeterioration and Biodegradation **SS L2T3**

Basic mechanisms of biodeterioration and biodegradation; direct and indirect attack mechanisms; co-metabolism and mixed population phenomena; factors controlling rates of degradation and recalcitrance of materials to biological attack; biological accelerators.

Detailed treatment of: biological corrosion of metals and alloys: biodeterioration of fuels, petrochemical products, synthetic materials, timber and cellulosic products, building materials etc.; degradation of rocks and minerals; biological leaching of ores and mineral processing residues.

The laboratory component includes assessment of biodegradability of common industrial materials (detergents, surface coatings, fuels, biocides etc); evaluation of protective methods; determination of biological leachability of minerals and mineral processing residues.

Zoology

Graduate Study

45.900G Ecological Studies in Arid Lands Management **S2 L2T4**

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 Botany are prescribed to cover aspects of vegetation description and plant/environment interactions.

Faculty of Applied Science

Environmental Studies

46.101G Project in Remote Sensing **C9**

A minor study of some aspects of remote sensing as it relates to investigations within a particular discipline or subject area offered by Schools within the Faculty of Applied Science.

46.102G Research Project in Remote Sensing **C18**

An investigation of a problem in remote sensing 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.

46.200G Research Project in Environmental Studies **C20**

Research investigation on an approved topic, conducted either individually or as part of a team.

46.203G 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, nitro-olefins, carbon monoxide, sulphur dioxide, oxides of nitrogen, hydrocarbons, ozone and oxidants, particulates, carcinogens.

46.204G 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.

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.

48.063G 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.

48.070G Process Principles

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

48.081G Advanced Process Dynamics

Distributed-Parameter Linear Systems: Selected distributed-parameter and mathematically similar systems. Methods of analysis and features of their response. Feedback systems containing deadtime. Heat exchangers. Distillation columns. *Non-linear Systems:* Selected non-linear systems, eg chemical reactors, flow systems, radiant heat transfer. Numerical solutions. Phase plane analysis. Limit cycles.

48.082G 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.

48.084G System Simulation and Control

This is a participatory course in which case studies, discussions 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 system 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 multi-loop systems; non-linear systems; digital control and data-logging, sequencing control.

48.085G 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.

48.086G 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, bubble-phase 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.

48.089G 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.

48.090G Specialist Lectures

48.091G 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.

48.092G 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.

48.093G 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.

48.131G Catalysts and Applied Reaction Kinetics **S1 or S2 L2T4**

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.

48.150G Instrumental Analysis for Industry **F L1T2**

Role of analysis in process optimization. Accuracies of analytical methods compared to needs for euality 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.

48.161G Electrochemical Techniques for Control and Analysis **S1 or S2 L2T4**

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.

48.180G Corrosion Materials **F L2**

Metallic: types available, properties and applications for each of the following: cast irons, alloy cast irons, carbon steels, low alloy steels, stainless steel, special alloys. The following metals and their alloys: aluminium, copper, nickel, titanium, lead, zinc, magnesium, tin cadmium, chromium, cobalt. Refractory metals: molybdenum, tantalum, tungsten, zirconium. Noble metals: gold, platinum, silver.

48.181G Industrial Coatings for Corrosion Protection **S1 L2**

Special topics on heavy-duty organic, inorganic and metallic coatings used in atmospheric, marine and industrial environments.

48.182G Non-metallic Materials for Corrosion Resistance **S1L2**

Thermosetting and thermoplastic polymers; natural and synthetic rubbers; glasses and glass linings; acid resisting ceramics; refractories.

48.183G Corrosion Technology **F L3**

Environmental fracture; corrosion in specific environments; corrosion of specific equipment types; principles of materials selection and design; surface preparation and maintenance coatings; polymeric materials and linings; inhibitors and electrochemical tests methods; cathodic protection.

48.184G Corrosion Project

A substantial project on some aspect of corrosion science or technology.

Department of Fuel Technology

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

48.380G 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.

48.382G 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.

48.383G 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.

48.384G 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.

48.385G 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.

48.386G 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.

48.387G Fuel Technology Practice

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

Department of Polymer Science

48.400G Polymer Science **F L3T3**

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

48.410G Analytical Characterization of Polymers **S1 or S2 L3T3**

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.

48.430G Polymer Engineering **S1 or S2 L4T2**

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.

48.440G Polymer Physics **S1 or S2 L4T2**

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.

48.900G Major Project

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

48.901G Minor Project

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

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 **Disciplines of the University: Faculty (Undergraduate Study)** in the Calendar.

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 **Disciplines of the University: 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 the Calendar.

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	Calendar 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

Title	Abbreviation	Calendar/Handbook
Master of Arts	MA	Arts Military Studies
Master of Biomedical Engineering	MBiomedE	Engineering
Master of Building	MBuild	Architecture
Master of the Built Environment Master of the Built Environment (Building Conservation)	MBEnv	Architecture
Master of Business Administration	MBA	AGSM
Master of Chemistry	MChem	Sciences*
Master of Commerce (Honours)	MCom(Hons)	Commerce
Master of Commerce	MCom	Commerce
Master of Education	MEd	Professional Studies
Master of Educational Administration	MEdAdmin	Professional Studies
Master of Engineering **Master of Engineering *without supervision***	**ME**	**Applied Science** Engineering Military Studies
Master of Engineering Science	MEngSc	Engineering Military Studies
Master of Environmental Studies	**MEnvStudies**	**Applied Science**
Master of General Studies	MGenStud	General Studies
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 Laws	LLM	Law
Master of Librarianship	MLib	Professional Studies
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 Psychology	MPsychol	Sciences§
Master of Safety Science	MSafetySc	Engineering
Master of Science **Master of Science *without supervision***	**MSc**	**Applied Science** Architecture Engineering Medicine Military Studies Sciences*§
Master of Science (Acoustics)	MSc(Acoustics)	Architecture

Higher Degrees (continued)

Title	Abbreviation	Calendar/Handbook
Master of Science (Biotechnology)	MSc(Biotech)	Sciences§
Master of Science (Building)	MSc(Building)	Architecture
Master of Science (Industrial Design)	MSc(IndDes)	Architecture
Master of Science (Psychology)	MSc(Psychol)	Sciences§
Master of Science and Society	MScSoc	Sciences*
Master of Social Work	MSW	Professional Studies
Master of Statistics	MStats	Sciences*
Master of Surgery	MS	Medicine
Master of Surveying 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 Diplomas

Graduate Diploma	GradDip	Applied Science Architecture Engineering Sciences*§
	DipPaed	Medicine
	DipEd DipIM-ArchivAdmin DipIM-Lib	Professional Studies
	DipFDA	Sciences*

*Faculty of Science.
§Faculty of Biological Sciences.

Higher Degrees

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 and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one calendar month before the commencement of the session in which enrolment is to begin.

(2) In every case, before permitting a candidate to enrol, the head of the school* in which the candidate intends to enrol shall be satisfied that adequate supervision and facilities are available.

(3) An approved candidate shall be enrolled in one of the following categories:
(a) full-time attendance at the University;
(b) part-time attendance at the University.

(4) A full-time candidate shall be fully engaged in advanced study and research except that the candidate may undertake not more than five hours per week or a total of 240 hours per year on work which is not related to the advanced study and research.

(5) Before permitting a part-time candidate to enrol, the Committee shall be satisfied that the candidate can devote at least 20 hours each week to advanced study and research for the degree which (subject to (8)) shall include regular attendance at the school* on an average of at least one day per week for 48 weeks each year.

(6) A candidate shall be required to undertake an original investigation on an approved topic. The candidate may also be required to undergo such assessment and perform such other work as may be prescribed by the Committee.

(7) The work shall be carried out under the direction of a supervisor appointed from the full-time academic members of the University staff.

(8) The work, other than field work, shall be carried out in a school* of the University except that the Committee:

(a) may permit a candidate to spend not more than one calendar year of the program in advanced study and research at another institution provided the work can be supervised in a manner satisfactory to the Committee;

(b) may permit a candidate to conduct the work at other places where special facilities not possessed by the University may be available provided the direction of the work remains wholly under the control of the supervisor;

(c) may permit a full-time candidate, who has been enrolled as a full-time candidate for at least six academic sessions, who has completed the research work and who is writing the thesis, to transfer to part-time candidature provided the candidate devotes at least 20 hours each week to work for the degree and maintains adequate contact with the supervisor.

(9) The progress of a candidate shall be reviewed annually by the Committee following a report by the candidate, the supervisor and the head of the school* in which the candidate is enrolled and as a result of such review the Committee may cancel enrolment or take such other action as it considers appropriate.

(10) No candidate shall be awarded the degree until the lapse of six academic sessions from the date of enrolment in the case of a full-time candidate or eight academic sessions in the case of a part-time candidate. In the case of a candidate who has had previous research experience the committee may approve remission of up to two sessions for a full-time candidate and four sessions for a part-time candidate.

(11) A full-time candidate for the degree shall present for examination not later than ten academic sessions from the date of enrolment. A part-time candidate for the degree shall present for examination not later than twelve academic sessions from the date of enrolment. In special cases an extension of these times may be granted by the Committee.

4. (1) On completing the program of study a candidate shall submit a thesis embodying the results of the investigation. **Thesis**

(2) The candidate shall give in writing to the Registrar two months notice of intention to submit the thesis.

(3) The thesis shall comply with the following requirements:

(a) it must be an original and significant contribution to knowledge of the subject;

(b) the greater proportion of the work described must have been completed subsequent to enrolment for the degree;

(c) it must be written in English except that a candidate in the Faculty of Arts 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;

*Or department where a department is not within a school.

(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 satisified 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

5. (1) There shall be not fewer than three examiners of the thesis, appointed by the Professorial Board on the recommendation of 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 candidate be awarded the degree without further examination; or

(b) the candidate be awarded the degree without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school*; or

(c) the candidate be awarded the degree subject to 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 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 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 be permitted to 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 Applied Science (MAppSc) and Master of Environmental Studies (MEnvStudies)

1. The degree of Master of Applied Science or Master of Environmental Studies by formal course work may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

Qualifications

2. (1) A candidate for the degree shall:

(a) have been awarded an appropriate degree of Bachelor of four full-time years duration (or the part-time equivalent) from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty of Applied Science (hereinafter referred to as the Committee), or

*Or department where a department is not within a school.

(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 of tertiary institution at a level acceptable to the Committee and

(ii) have undertaken appropriate postgraduate studies of one full-time year's duration (or the part-time equivalent) at the University of New South Wales or studies considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the degree shall be required to undertake such formal subjects including the submission of a report on a project, and pass such assessment as prescribed. The project shall be under the supervision of an academic staff member and shall be assessed by two examiners (for a major project).

(3) The progress of a candidate shall be reviewed at least once a year by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the degree until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate and four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate, eight sessions for a part-time candidate, and ten sessions for an external candidate. In special cases an extension of these times may be granted by the Committee.

Fees

4. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering (ME) and Master of Science (MSc)

1. The degree of Master of Engineering or Master of Science by research may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the degree.

(3) When the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant, before being permitted to enrol, to undergo such examination or carry out such work as the Committee may prescribe.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one calendar month before the commencement of the session in which enrolment is to begin.

(2) In every case, before permitting a candidate to enrol, the head of the school* in which the candidate intends to enrol shall be satisfied that adequate supervision and facilities are available.

(3) An approved candidate shall be enrolled in one of the following categories:

*Or department where a department is not within a school.

(a) full-time attendance at the University;

(b) part-time attendance at the University;

(c) external — not in regular attendance at the University and using research facilities external to the University.

(4) A candidate shall be required to undertake an original investigation on an approved topic. The candidate may also be required to undergo such examination and perform such other work as may be prescribed by the Committee.

(5) The work shall be carried out under the direction of a supervisor appointed from the full-time members of the University staff.

(6) The progress of a candidate shall be reviewed annually by the Committee following a report by the candidate, the supervisor and the head of the school* in which the candidate is enrolled and as a result of such review the Committee may cancel enrolment or take such other action as it considers appropriate.

(7) No candidate shall be granted the degree until the lapse of three academic sessions in the case of a full-time candidate or four academic sessions in the case of a part-time or external candidate from the date of enrolment. In the case of a candidate who has been awarded the degree of Bachelor with Honours or who 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 Professorial 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) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the merits of the thesis and shall recommend to the Committee that:

(a) the candidate be awarded the degree without further examination; or

(b) the candidate be awarded the degree without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school*; or

(c) the candidate be awarded the degree subject to 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.

*Or department where a department is not within a school.

(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.

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Fees

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.

Master of Engineering (ME), Master of Science (MSc) and Master of Surveying (MSurv) *without supervision*

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.

Qualifications

3. An application to enrol as a candidate for the degree without supervision shall be made on the prescribed form which shall be lodged with the Registrar not less than six months before the intended date of submission of the thesis. A graduate who intends to apply in this way should, in his or her own interest, seek at an early stage the advice of the appropriate head of school* with regard to the adequacy of the subject matter and its presentation for the degree. A synopsis of the work should be available.

Enrolment

4. (1) A candidate shall submit a thesis embodying the results of the investigation.

Thesis

(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.

5. (1) There shall be not fewer than two examiners of the thesis, appointed by the Professorial 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.

Examination

(2) Before the thesis is submitted to the examiners the head of the school* in which the candidate is enrolled shall certify that it is *prima facie* worthy of examination.

(3) At the conclusion of the examination each examiner shall submit to the Committee 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

*Or department where a department is not within a school.

(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)

1. A Graduate Diploma may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

Qualifications

2. (1) A candidate for the diploma shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee).

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the diploma.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the diploma shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the diploma shall be required to undertake such formal subjects and pass such assessment as prescribed.

(3) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the diploma until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate and six sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

Fees

4. A candidate shall pay such fees as may be determined from time to time by the Council.

Scholarships and Prizes

The scholarships and prizes listed below are available to students whose courses are listed in this 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 scholarships 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 Room G20, located on the Ground Floor of the Chancellery.

Unless otherwise indicated in footnotes, applications for the following scholarships should be made to the Registrar 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

*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)			
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
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.
Universities Credit Union	$500 pa	1 year with the possibility of renewal	Prior completion of at least 1 year of any undergraduate degree course. Eligibility limited to members of the Universities Credit Union Ltd of more than one year's standing or members of the family of such members.

**Applications close 30 September each year.

Applied Science

Biological Technologies

Food Science and Technology

Coca-Cola Export Corporation	Up to $1500 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.
Food Technology Association	Up to $1000 pa		
George Weston Foods Ltd	Up to $4000 over 4 years		

Undergraduate Scholarships (continued)

Applied Science (continued)

Chemical Engineering and Industrial Chemistry

Donor	Value	Year/s of Tenure	Conditions
Bridge Oil Ltd	Up to $5000 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia living in Queensland and must have completed the first two years of any accredited engineering program in that state
Dow Chemical (Australia)	Up to $1000 pa		Permanent residence in Australia and eligibility for admission to Year 2 of the full-time degree course in Chemical Engineering
Fielder Gillespie Ltd	Up to $1000 pa		Permanent residence in Australia and eligibility for admission to Year 2 of the full-time degree course in Chemical Engineering or Industrial Chemistry
ICI Australia Operations Ltd	Up to $1000 pa		Eligibility for admission to Year 4 of the full-time degree course in Chemical Engineering
Shell Refining (Australia) Pty Ltd	Up to $1500 pa		Eligibility for admission to Year 2 of the full-time degree course in Chemical Engineering
Society of Petroleum Engineers Pty Ltd (WA)	Up to $2500		Permanent residence in Australia living in Western Australia and must have completed the first two years of any accredited engineering program in that state

Fibre Science and Technology

Textile Technology

Australian Wool Corporation	$3821 pa	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
Bonds Industries Ltd	$2477 pa		
Bruck (Australia) Limited	$3821 *or* $2477 pa		
Fibremakers Division of ICI Australia Operations Pty Ltd	$3821 *or* $2477 pa		
Reckitt's Toiletries International	Up to $1500 pa		
Textile Council of Australia	$3821 *or* $2477 pa		
National Council of Wool Selling Brokers of Australia	Up to $2500 pa		Eligibility for admission to the full-time degree course in Textile Technology
Webco	$500 pa		

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Applied Science (continued)			
Wool Science			
National Australia Bank	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
National Council of Wool Selling Brokers of Australia	Up to $2500 pa		
Merck, Sharp and Dohme	Up to $1000 pa		
Materials Science and Engineering			
Materials			
Australian Ceramic Society	Up to $300 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
Australian Consolidated Industries Ltd	Up to $600 pa		
The Brick Manufacturers' Association of New South Wales	Up to $1000 pa		
Ceramco Limited	Up to $1000 pa		
Ferro Corporation	Up to $600 pa		
Fowlerware	Up to $500 pa		
Monier Limited	Up to $1000 pa		
North Sydney Brick and Tile Co Ltd	Up to $1000 pa		
Plessey Australia Pty Ltd	Up to $1000 pa		
Swan Resources Ltd	Up to $1000 pa		
The Thomson Family	Up to $1000 pa		
Zacuba Pty Ltd	Up to $750 pa		
Metallurgy			
Sandvik Australia Pty Ltd	Up to $1250 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 Metallurgy or Metallurgical Process Engineering
Sir Rupert Myers	Up to $1500 pa		
Industrial Sponsors Program	Up to $1500 pa		Eligibility for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Process Engineering

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Applied Science (continued)			
Mines			
Applied Geology			
BP Coal Australia	Up to $500 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Permanent residence in Australia and enrolled in Year 4 of the Applied Geology or Mining Geology degree course (or equivalent program in the sciences)
Mining Engineering			
Stan Sawyer Memorial Scholarship to Coal Mining Students	Up to $200 pa		Eligibility for admission to Year 3 or Year 4 of the full-time degree course in Mining Engineering

Graduate Scholarships

Application forms and further information are available from the Student Enquiry Counter, located on the Ground Floor of the Chancellery. 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*.

Where possible, the scholarships are listed in order of faculty.

Donor	Value	Year/s of Tenure	Conditions
General			
University of New South Wales Postgraduate Scholarships	Living allowance of $7000 pa. Other allowances may also be paid.	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			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 $8126 pa. Other allowances may also be paid.	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. Preference is given to applicants with employment experience. Applications to Registrar by 30 September.
Australian American Educational Foundation Travel Grant (Fulbright)**			Applicants must be graduates, senior scholars or post-doctoral Fellows. Applications close 30 September.

*Available for reference in the University Library.

**Application forms are available from The Secretary, Department of Education and Youth Affairs, AAEF Travel Grants, PO Box 826, Woden, ACT 2606.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
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
The Caltex Woman Graduate Scholarships	Six State awards of $5000 each One National award valued at $22,000 pa for study at an approved overseas institution.	1 year 2 years	Applicants must be female graduates who will have completed a University degree or diploma this year and who are Australian citizens or have resided in Australia for at least seven years. Selection is based on scholastic and literary achievements, demonstrable qualities of character and accomplishments in cultural and/or sporting/recreational activities. Applications close late September.
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. Applications close with Registrar in September or October each year.
The English-Speaking Union (NSW Branch)	$5000		Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia. Applications close mid-April.
Frank Knox Memorial Fellowships at Harvard University	Stipend of US$6500 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 Registrar mid-October.
Gowrie Scholarship Trust Fund	$4000 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 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: **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 31 August.

**Application forms must be obtained from the Australian representative of the Fund, Mr J. T. Larkin, Department of Trade, Edmund Barton Building, Kings Avenue, Barton, ACT 2600. These must be submitted to the Registrar by 15 August.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
The Rhodes Scholarship*	Approximately £3600 stg pa	2 years, may be extended for a third year	Unmarried male and female Australian citizens aged between 19 and 25 who have been domiciled in Australia at least 5 years and have completed at least 2 years of an approved university course. Applications close in mid-September each year.
Rothmans Fellowships Award††	$20000 pa	1 year, renewable up to 3 years	The field of study is unrestricted. Applicants must have at least 3 years graduate experience in research. Applications close in July.
Sam Cracknell Memorial	Up to $3000 pa		See above under **Undergraduate Scholarships, *General***
Applied Science			
Australian Pig Industry Research Committee Postgraduate Awards	$8126 pa plus allowances	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.	Applications close 31 August
Australian Wool Corporation Research Scholarship in Textile Technology			Applicants must be graduates in textile physics, textile chemistry, or textile engineering
Australian Wool Corporation Research Scholarship in Wool and Pastoral Sciences			Applicants must be graduates in applied science, agricultural science or veterinary science
Australian Meat Research Committee Award†		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. Applications close 31 July.

*Applications to The Honorary Secretary of the NSW Committee, University of Sydney, NSW 2006.
††Applications to the Secretary, Rothmans University Endowment Fund, University of Sydney, NSW 2006.
†Application forms from Executive Officer, Australian Meat Research Committee, GPO Box 4129, Sydney 2001.

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 of the Chancellery.

Donor/Name of Prize	Value $	Awarded for
General		
Sydney Technical College Union Award	150.00 and medal	Leadership in the development of student affairs, and academic proficiency throughout the course
University of New South Wales Alumni Association	Statuette	Achievement for community benefit – students in their final or graduating year

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
Faculties of Applied Science and Engineering		
Institution of Engineers, Australia	Medal and 200.00	The most proficient final year (or last 2 years part-time) student in the Bachelor of Engineering (or Bachelor of Science (Engineering)) degree courses offered by the following Schools: Civil Engineering Electrical Engineering and Computer Science Mechanical and Industrial Engineering Chemical Engineering and Industrial Chemistry Mining Engineering Textile Technology (Engineering option only)
School of Applied Geology		
F. C. Loughnan — in Applied Geology	340.00	Most outstanding student in Year 3 of the Geology course
School of Biological Technologies		
Department of Biotechnology		
Mauri Foods	175.00	Best result in 42.101 Introduction to Biotechnology
	175.00	Best result in one of the Level 3 Biotechnology subjects
	175.00	Best result in the Biotechnology honours degree program
Department of Food Science and Technology		
Cottees General Foods	120.00	38.141 Food Regulation and Control
Nestle Australia Pty Ltd	200.00	Best performance in 38.140 Food Technology project in the Bachelor of Science degree course in Food Technology
Wilfred B. S. Bishop	75.00	General proficiency throughout Bachelor of Science degree course in Food Technology by a student who has made a significant contribution to staff and student activities
School of Chemical Engineering and Industrial Chemistry		
Abbott Laboratories Pty Ltd	150.00	Bachelor of Engineering degree course in Chemical Engineering - Year 4
Australasian Corrosion Association (NSW Branch)	150.00 and one year's membership of the Association	Best performance in 48.121 Corrosion in the Chemical Industry
The Australian Gas Light Company's in Chemical Engineering	200.00	Subject selected by Head of School

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Chemical Engineering and Industrial Chemistry (continued)		
Australian Paper Manufacturers Ltd	100.00	48.163 Instrumentation and Process Control in Industrial Chemistry
	100.00	48.163 Instrumentation and Process Control in Chemical Engineering
Chemical Technology Society	25.00	Best graduate in Bachelor of Science degree in Industrial Chemistry
	25.00	Best graduate in Bachelor of Science degree course in Industrial Chemistry, Years 1 and 2 or Stages 1 to 4
CSR Limited	50.00	Subject within the discipline of Industrial Chemistry, selected by Head of School
Esso Australia Ltd	200.00	Best performance in Year 2 Chemical Engineering
Institution of Chemical Engineers	100.00 and medal	Best result for the thesis in the final year, or equivalent part time stage, of the Bachelor of Engineering degree course
Shell	100.00	General proficiency in Year 2 or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course
	100.00	General proficiency in Year 3 or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course
	100.00	General proficiency in Year 4 or its part-time equivalent in either the Chemical Engineering course or the industrial Chemistry course
	100.00	For a student who, in the opinion of the Head of School, has performed some meritorious activity of note either inside or outside the University
Simon-Carves Australia	21.00	48.135 Thermodynamics
Stauffer Australia Limited	100.00	Subject selected by Head of School
Western Mining Corporation Ltd	150.00	48.036 Chemical Engineering Laboratory 1
	150.00	48.044 Chemical Engineering Laboratory 2
Department of Fuel Technology		
Australian Institute of Energy	50.00	For a fuel subject or allied subject project
Fuel Technology Staff	200.00	Best performance in Year 3 or 4 Fuel Technology subject in the Bachelor of Engineering degree course in Chemical Engineering
Shell	150.00	Subject selected by Head of School
School of Civil Engineering		
Association of Consulting Structural Engineers of New South Wales	225.00	Best performance in 8.4430 Structural Design 4 in the Bachelor of Engineering degree course in Civil Engineering
	175.00	Best performance in 8.3440 Structural Design 3 in the Bachelor of Engineering degree course in Civil Engineering

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Civil Engineering (continued)		
Australian Conservation Foundation	50.00	Best performance in the subjects which develop environmental management concepts for the Civil Engineer
Australian Welding Institute	Books to the value of 30.00	Best design which incorporates a welding process for students in Years 2, 3 or 4 of the Bachelor of Engineering degree course in Civil Engineering
Crawford Munro Memorial	150.00	Best performance in 8.3640 Engineering Hydrology in the Bachelor of Engineering degree course in Civil Engineering
James Hardie & Co. Pty Ltd	225.00	Best performance in 8.2610 Hydraulics 1 in the Bachelor of Engineering degree course in Civil Engineering
Hornibrook	200.00	Best performance in Engineering Construction and Management in the Bachelor of Engineering degree course in Civil Engineering
Jeffrey and Katauska	500.00	Best performance in 8.4310 Materials Major in the Bachelor of Engineering degree course in Civil Engineering
Water Board Gold Medal	Medal	Highest aggregate in 8.3630 Water Supply and Wastewater Disposal and 8.4620 Water Resources Engineering in the Bachelor of Engineering degree course in Civil Engineering
School of Geography		
Jack Mabbutt Medal	Medal	Best performance in Fourth Year Project in Applied Geography by a student proceeding to Bachelor of Science
Jack Mabbutt Prize	150.00	Best performance by a third year student proceeding to Honours in Geography
School of Fibre Science and Technology		
Department of Textile Technology		
J. B. Speakman	50.00	Undergraduate thesis
Textile Institute	Two years' membership of the Institute	Best performance in 13.113 Textile Technology 3 in the Bachelor of Science in Textile Technology degree course
R. J. Webster	250.00	General proficiency throughout the Bachelor of Science degree course in Textile Technology

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Fibre Science and Technology (continued)		
Department of Wool Science		
Bayer Animal Health	120.00	General proficiency - Wool and Pastoral Sciences degree course, Year 2 and Year 3
C. R. Lucock	A book or a voucher to the value of 60.00 payable to University Co-op Bookshop Limited	Meat Science
Parkes Wool Promotion Committee	A shield held in the Department of Wool Science on which the successful student's name is engraved each year	Best performance in Practical Wool Studies in the Bachelor of Science degree course in Wool and Pastoral Sciences
P. R. McMahon Memorial	100.00	Excellence in Wool Science
School of Mathematics		
Applied Mathematics	50.00	Excellence in Level III Applied Mathematics subjects
C. H. Peck	50.00	Best performance in Year 2 Mathematics proceeding to Year 3 in the School of Mathematics
Head of School's	50.00	Excellence in 4 or more Mathematics units in Year 2
IBM	150.00	Final year of an honours degree course
ICI Theory of Statistics IV	100.00	Best performance in 10.323 Theory of Statistics 4
I. P. Sharp Associates	75.00	Excellence in Higher Theory of Statistics 2
J. R. Holmes	50.00	Excellent performance in at least 4 pass-level (up to 1 pass-level unit may be replaced by a higher-level unit) Pure Mathematics Level III units taken over no more than two consecutive years
Michael Mihailavitch Erihman	750.00	Best performance by a student enrolled in a Mathematics Program, in examinations conducted by the School of Mathematics in any one year
Pure Mathematics	50.00	Best performance in Level III Pure Mathematics subjects
School of Mathematics	50.00	Best performance in 10.011 Higher Mathematics 1
	50.00	Best performance in basic Year 2 Higher Mathematics units
	50.00	Excellence in 4 or more Mathematics units in Year 2
Statistical Society of Australia (New South Wales Branch)	70.00	General proficiency - Theory of Statistics subjects
W. D. & H. O. Wills (Aust) Ltd Theory of Statistics 3	200.00	Best performance in Theory of Statistics 3 or Higher Theory of Statistics 3

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Materials Science and Engineering		
Alcan Australia Ltd	100.00	Subject selected by Head of School
Austral Crane	150.00	
Australian Institute of Metals	100.00 and one year's membership of the Institute	
Australian Welding Institute	30.00 Book order	
The Broken Hill Proprietary Co Ltd	150.00	
The Max Hatherly	275.00	Best performance in the final year practical examination *or* an outstanding effort in Metallography
The Hugh Muir	275.00	Best performance in the final year seminar class *or*, as judged by the Head of School, the contribution by a student most of all to the corporate life of the School of Materials Science and Engineering
Western Mining Corporation Ltd	150.00	Best overall performance in Year 3 full-time (or its equivalent part-time) in Bachelor of Engineering (or Bachelor of Science (Technology)) degree course
	150.00	Best overall performance in Year 4 full-time (or its equivalent part-time) in the Bachelor of Engineering (or Bachelor of Science (Technology)) degree course
Zinc Corp Ltd	200.00	Subject selected by Head of School
School of Mines		
Joint Coal Board	200.00	Bachelor of Engineering degree course in Mining Engineering, Year 2
	200.00	Bachelor of Engineering degree course in Mining Engineering, Year 3
	300.00	Bachelor of Engineering degree course in Mining Engineering — general proficiency throughout course
School of Physics		
Australian Institute of Physics	100.00 and one year's membership of the Institute	Highest aggregate in any 3 units chosen from 1.0133 Quantum Mechanics, 1.0143 Nuclear Physics, 1.023 Statistical Mechanics and Solid State Physics, 1.0333 Electromagnetism, 1.0343 Advanced Optics, and 1.043 Experimental Physics A in the Bachelor of Science
Bodal in Microcomputers	100.00	Best performance in a competition based on the use of microcomputers in 1.061 Computer Applications in Experimental Science 1
ETP–Oxford	200.00	Most meritorious design study of an optical system in the subject 1.713 Advanced Laser and Optical Applications
Gordon and Mabel Godfrey in Theoretical Physics 3	100.00	Best performance in a selection of Year 3 Theoretical Physics subjects chosen from 1.5133, 1.5233, 1.5333, 1.5433 and 1.5533

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Physics (continued)		
Gordon and Mabel Godfrey in Theoretical Physics 4	100.00	Excellence in the subject 1.504 Theoretical Physics 4 in the Bachelor of Science degree course with Honours in Physics
Gordon and Mabel Godfrey	300.00	Best performance by a student who has completed third year and is entering the final year of the Honours Degree course in Theoretical Physics
Head of School's in Physics	50.00	Best Year 4 Honours Thesis in Physics in the Bachelor of Science degree course
Laser Electronics	200.00	Excellence in the laboratory work of 1.763 Laser and Optical Technology Laboratory 1
Monaro Research	200.00	Excellence in the subject 1.713 Advanced Laser and Optical Applications
Parameters in Electronics	200.00	Excellence in 1.133 Electronics, or, if no student of sufficient merit 1.043 Experimental Physics A and 1.763 Laser and Optical Technology Laboratory 1
Physics Staff for Physics 1	100.00	Best performance in 1.001 Physics 1
Physics Staff for Physics 2	100.00	Highest aggregate in 1.002 Mechanics, Waves and Optics, 1.012 Electromagnetism and Thermal Physics, 1.022 Physics and 1.032 Modern Laboratory in the Bachelor of Science degree course
Physics Staff for Physics Honours	100.00	Best performance in the Physics Honours Year of the Bachelor of Science degree course
Radiation Research	200.00	Excellence in the laboratory work in 1.773 Laser and Optical Technology Laboratory 2
School of Political Science		
Australian Institute of Political Science	50.00 and three years' asociate membership of the Institute including subscription to *Australian Quarterly* and free conference registration in year following award	Political Science Year 1
David Vogel Memorial	75.00	Political Science Year 3
Shell	150.00	Distinguished performance in the Political Science degree course
Staff of the School of Political Science	50.00	Political Science Year 2
The Sydney Morning Herald	100.00	Political Science Year 2 or later

Graduate University Prizes

The following table summarizes the graduate prizes awarded by the University.

Donor/Name of Prize	Value $	Awarded for
School of Chemical Engineering and Industrial Chemistry		
The Clean Air Society of Australia and New Zealand	100.00	48.391G Atmospheric Pollution Control and 48.392G Practical Aspects of Air Pollution Measurement and Control
School of Fibre Science and Technology		
Department of Textile Technology		
Malcolm Chaikin	200.00 and bronze medal	For the most outstanding thesis for the degree of Doctor of Philosophy in the Department of Textile Technology

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

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Associate Professor J. P. Kennedy

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Senior Project Officer

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Oto Zubzanda, DipIng *T.U. Bratislava*, PhD *N.S.W.*
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Max Renner

School of Biological Technologies

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Department of Biotechnology

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Department of Food Science and Technology

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Gour Chand Sen, MSc *Wales*, PhD *Durh.*, CEng, FIExpE, FIMinE

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Drago Panich, BE *N.S.W.*, MSc *N'cle (U.K.)*

Tutor

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The University of New South Wales Kensington Campus 1987

Theatres

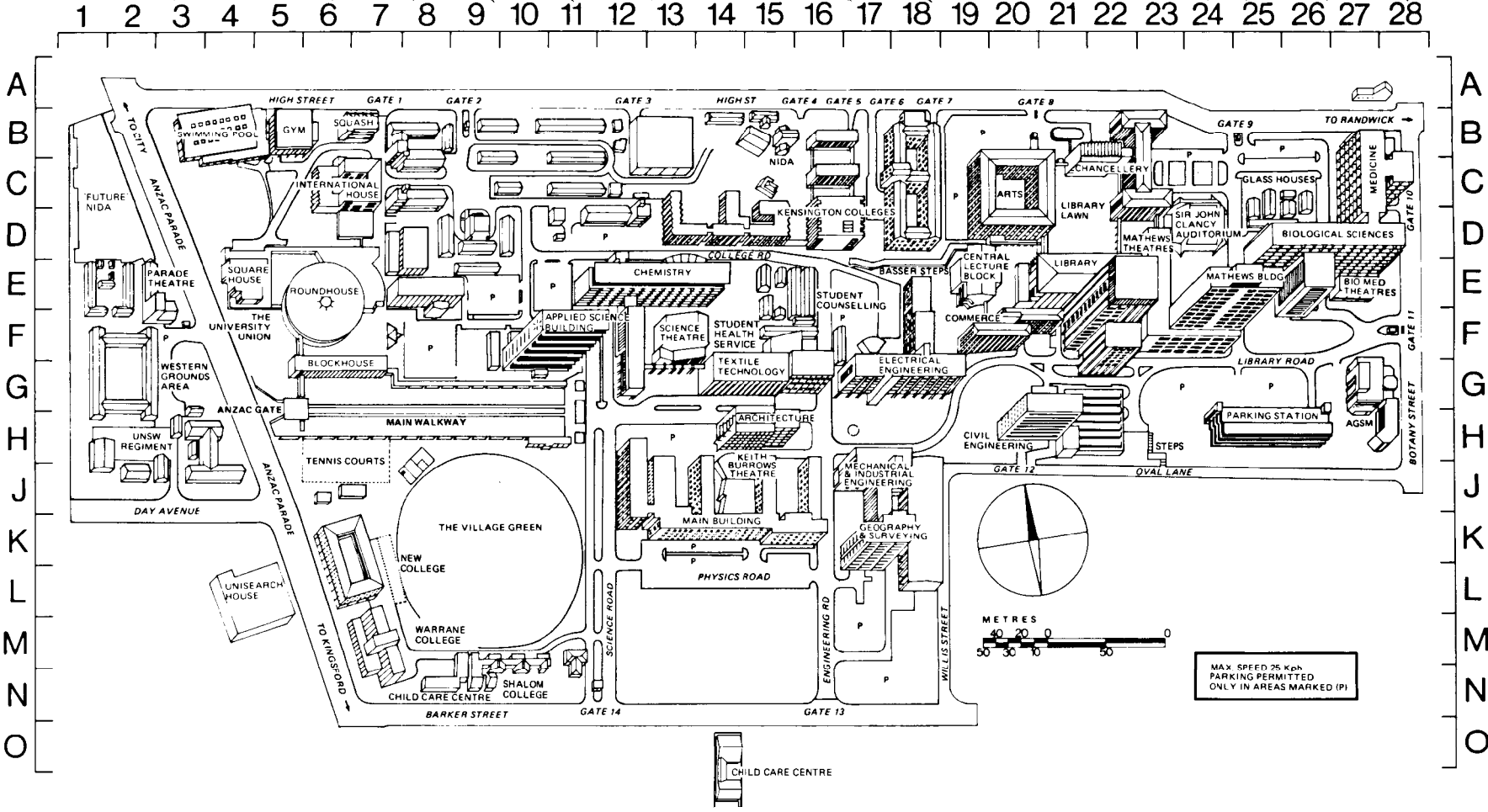
Biomedical Theatres **E27**
Central Lecture Block **E19**
Classroom Block (Western Grounds) **H3**
Rex Vowels Theatre **F17**
Keith Burrows Theatre **J14**
Main Building Theatrette **K14**
Mathews Theatres **D23**
Parade Theatre **E3**
Science Theatre **F13**
Sir John Clancy Auditorium **C24**

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 (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) **F20**
Kanga's House **O14**
Kensington Colleges **C17 (Office)**
Basser **C18**
Goldstein **D16**
Philip Baxter **D14**
Main Building **K15**
Maintenance Workshop **B13**
Mathews **F23**
Mechanical and
Industrial Engineering **J17**
Medicine (Administration) **B27**
Menzies Library **E21**
Metallurgy **E8**
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**
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**
Wool and Pastoral Sciences **B8**

General

Academic Staff Office **C22**
Accountancy **F20**
Admissions **C22**
Adviser for Prospective Students **F15**
Alumni and Ceremonials **C22**
Anatomy **C27**
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**
Biochemistry **D26**
Biological Sciences (Faculty Office) **D26**
Biomedical Library **F23**
Biotechnology **D26**
Bookshop **G17**
Botany **D26**
Building **H14**
Careers and Employment **F15**
Cashier's Office **C22**
Centre for Biomedical Engineering **A28**
Centre for Medical Education
Research and Development **C27**
Centre for Remote Sensing **K17**
Chaplains **E15a**
Chemical Engineering and
Industrial Chemistry **F10**
Chemistry **E12**
Child Care Centres **N8, O14**
Civil Engineering **H20**
Commerce (Faculty Office) **F20**
Committee in Postgraduate Medical
Education **B27**
Community Medicine **D26**
Computing Services Unit **F21**
Continuing Education Support Unit **F23**
Economics **F20**
Education **G2**
Education Testing Centre **E15d**
Electrical Engineering and
Computer Science **G17**
Energy Research, Development and
Information Centre **B8b**
Engineering (Faculty Office) **K17**
English **C20**
Examinations **C22**
Fees Office **C22**
Food Science and Technology **F10**
French **C20**
General Staff Office **C22**
General Studies **C20**
Geography **K17**
German Studies **C20**
Graduate School of the Built
Environment **H14**
Health Administration **C22**
History **C20**
History and Philosophy of Science **C20**
Industrial Arts **H14**
Industrial Engineering **J17**
Institute of Rural Technology **B8b**
Japanese Economic Management
Studies Centre **G14**
Kanga's House **O14**
Kindergarten (House at Pooh Corner) **N8**
Landscape Architecture **K15**
Law (Faculty Office) **F21**
Law Library **F21**
Librarianship **F23**
Library **E21**
Lost Property **F20**
Marketing **F20**
Mathematics **F23**
Mechanical Engineering **J17**
Medicine (Faculty Office) **B27**
Metallurgy **E8**
Microbiology **D26**
Mining Engineering **K15**
Music **B11b**
National Institute of Dramatic Art **D2**
Nuclear Engineering **J17**
Off-campus Housing **C22**
Optometry **J12**
Organizational Behaviour **F20**
Pathology **C27**
Patrol and Cleaning Services **F20**
Philosophy **C20**
Physics **K15**
Physical Education and
Recreation Centre (PERC) **B5**
Physiology and Pharmacology **C27**
Political Science **C20**
Psychology **F23**
Public Affairs Unit **C22**
Regional Teacher Training Centre **C27**
Russian **C20**
Science and Mathematics Course
Office **F23**
Social Work **G2**
Sociology **C20**
Spanish and Latin American Studies **C20**
Sport and Recreation **E4**
Student Counselling and Research **F15**
Student Health **F15**
Student Records **C22**
Students' Union **E4 and C21**
Surveying **K17**
Tertiary Education Research Centre **E15d**
Textile Technology **G14**
Theatre Studies **B10**
Town Planning **K15**
University Archives **C22**
University Press **A28**
University Union (Blockhouse) **G6**
Wool and Pastoral Sciences **B8a**
Zoology **D26**


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
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
SQUASH
INTERNATIONAL HOUSE
NIDA
FUTURE NIDA
KENSINGTON COLLEGES
ARTS
CHANCELLERY
GLASS HOUSES
MEDICINE
LIBRARY LAWN
SIR JOHN CLANCY AUDITORIUM
MATHEWS THEATRES
BIOLOGICAL SCIENCES
GATE 10
COLLEGE RD
CHEMISTRY
BASSER STEPS
CENTRAL LECTURE BLOCK
LIBRARY
MATHEWS BLDG
BIO MED THEATRES
PARADE THEATRE
SQUARE HOUSE
ROUNDHOUSE
THE UNIVERSITY UNION
APPLIED SCIENCE BUILDING
SCIENCE THEATRE
STUDENT HEALTH SERVICE
STUDENT COUNSELLING
COMMERCE
GATE 11
BLOCKHOUSE
TEXTILE TECHNOLOGY
ELECTRICAL ENGINEERING
LIBRARY ROAD
WESTERN GROUNDS AREA
ANZAC GATE
MAIN WALKWAY
ARCHITECTURE
PARKING STATION
AGSM
BOTANY STREET
UNSW REGIMENT
TENNIS COURTS
KEITH BURROWS THEATRE
MECHANICAL & INDUSTRIAL ENGINEERING
CIVIL ENGINEERING
STEPS
GATE 12
OVAL LANE
DAY AVENUE
THE VILLAGE GREEN
MAIN BUILDING
GEOGRAPHY & SURVEYING
NEW COLLEGE
PHYSICS ROAD
UNISEARCH HOUSE
WARRANE COLLEGE
SCIENCE ROAD
ENGINEERING RD
WILLIS STREET
TO KINGSFORD
CHILD CARE CENTRE
SHALOM COLLEGE
BARKER STREET
GATE 14
GATE 13
METRES
40 20 0 0
50 30 10 50
MAX. SPEED 25 Kph
PARKING PERMITTED
ONLY IN AREAS MARKED (P)
CHILD CARE CENTRE

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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, Engineering, Law, Medicine, Professional Studies, Science (including Biological Sciences and the Board of Studies in Science and Mathematics), the Australian Graduate School of Management (AGSM) and the Board of Studies in General Education.

The Calendar and Handbooks are available from the Cashier's Office.

The Calendar costs $6.00 (plus postage $1.40, interstate $1.80).

The Handbooks vary in cost: Applied Science, Architecture, Arts, Commerce, Engineering, Professional Studies, and Sciences are $4.00. Postage is $1.40 in each case ($1.80 interstate). Law, Medicine and AGSM are $3.00. Postage is $1.00 in each case ($1.10 interstate).

A set of books is $43.00. Postage is $3.00 ($7.00 interstate).

The General Studies Handbook is free. Postage is $1.00 ($1.10 interstate).