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The University of New South Wales

Applied Science

1984 Faculty Handbook

How to use this Handbook

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

General Information (the India coloured pages) 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.

Graduate Study is about higher degrees.

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 unit values, credit hours, teaching hours per week, sessions when taught

Financial Assistance to Students is a list of scholarships and prizes, available at undergraduate and graduate level in the faculty.

Staff list.

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

UNIVERSITY OF NEW SOUTH WALES
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Applied Science

1984 Faculty Handbook

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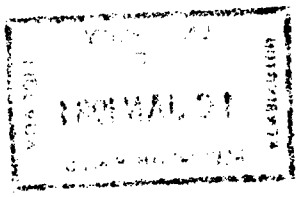

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Subjects, courses and any arrangements for courses including staff allocated, as stated in the Calendar or any Handbook or any other publication, announcement or advice of the University, are an expression of intent only and are not to be taken as 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 12 September 1983, 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.

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 **Deputy Registrar (Student Services)**, Mr Peter O'Brien, and members of his staff, are located on the first floor of the Chancellery. They 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 they are especially concerned with the problems of overseas, Aboriginal, and physically handicapped and disabled students. Enquire at Room 148E, phone 2482.

Note: All phone numbers below are University extension numbers. If you are outside the University, dial 6630351 and ask for the extension. Alternatively you may dial 662 and then the extension number. This prefix should only be used when you are certain of the extension that you require as callers using 662 cannot be transferred to any other number.

The **Assistant Registrar (Admissions and Examinations)**, Mr Jack Hill, is located on the ground floor of the Chancellery. General inquiries should be directed to 3715. For information regarding examinations, including examination timetables and clash of examinations, contact the **Senior Administrative Officer**, Mr John Grigg, phone 2143.

The **Assistant Registrar (Student Records and Scholarships — Undergraduate and Postgraduate)**, Mr Graham Mayne is located on the ground floor of the Chancellery. For particular enquiries regarding illness and other matters affecting performance in examinations and assessment, academic statements, graduation ceremonies, prizes, release of examination results and variations to enrolment programs, phone 3317.

The **Adviser for Prospective Students**, Mrs Fay Lindsay, is located in the Chancellery and is available for personal interview. For an appointment phone 3453.

The **Assistant Registrar (Careers and Employment)**, Mr Jack Foley, is located in the Chancellery. Enquiries should be directed to 3259.

The **Off-campus Housing Officer**, Mrs Judy Rawson, is located in Room 148E in the Chancellery. For assistance in obtaining suitable accommodation phone 3260.

Student Loans enquiries should be directed to Mrs Judy Rawson, Room 148E in the Chancellery, phone 3164.

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 2679, 2678 or 2677.

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 3681 or 3685 for an appointment.

The **University Librarian** is Mr Allan Horton. Library enquiries should be directed to 2048.

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

The **Students' Union** is located on the second floor of Stage III of the University Union, where the SU President, Secretary-Treasurer, Education Vice-President, Women's Officer, Director of Overseas Students and a full-time solicitor employed by the Students' Union are available to discuss any problems you might have.

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 five 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.

1984

Faculties other than Medicine

Session 1	5 March to 13 May
(14 weeks)	*May Recess:* 14 May to 20 May
	21 May to 17 June
	Midyear Recess: 18 June to 22 July
Examinations	19 June to 4 July
Session 2	23 July to 26 August
(14 weeks)	*August Recess:* 27 August to 2 September
	3 September to 4 November
	Study Recess: 5 November to 11 November
Examinations	12 November to 30 November

Faculty of Medicine

First and Second Years	As for other faculties	
Third and Fourth Years	Term 1 (10 weeks)	23 January to 1 April
	Term 2 (9 weeks)	9 April to 13 May
	May Recess:	14 May to 20 May
		21 May to 17 June
	Term 3 (9 weeks)	25 June to 26 August
	August Recess:	27 August to 2 September
	Term 4 (10 weeks)	3 September to 11 November
Fifth Year	Term 1 (8 weeks)	23 January to 18 March
	Term 2 (8 weeks)	26 March to 20 May
	Term 3 (8 weeks)	28 May to 22 July

Term 4 (8 weeks)	30 July to 23 September
Term 5 (8 weeks)	2 October to 25 November

January

Monday 2	Public Holiday — New Year's Day
Friday 13	Last day for acceptance of applications by office of the Admissions Section for transfer to another undergraduate course within the University
Monday 16	Last day for applications for review of results of assessment
Monday 30	Public Holiday — Australia Day

February

Wednesday 1	Enrolment period begins for new undergraduate students and undergraduate students repeating first year
Monday 20	Enrolment period begins for second and later year undergraduate students and graduate students enrolled in formal courses
Tuesday 28	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 5	**Session 1 begins** — all courses except Medicine III, IV and V
Wednesday 7	List of graduands for April/May ceremonies and 1983 prizewinners published in *The Sydney Morning Herald*
Monday 12	Last day for notification of correction of details published in *The Sydney Morning Herald* on 7 March concerning April/May graduation ceremonies
Friday 16	Last day for acceptance of enrolment by new undergraduate students (late fee payable thereafter)
Friday 30	Last day for acceptance of enrolment by undergraduate students re-enrolling in second and later years (late fee payable thereafter)

April

Thursday 19	Last day for undergraduate students to discontinue without failure subjects which extend over Session 1 only
Friday 20	Good Friday — Public Holiday
Saturday 21	Easter Saturday — Public Holiday
Monday 23	Easter Monday — Public Holiday
Wednesday 25	Anzac Day — Public Holiday

May

Wednesday 2	*Confirmation of Enrolment* forms despatched to all students
Friday 11	Last day for acceptance of corrected *Confirmation of Enrolment* forms
Monday 14	**May Recess begins**
Wednesday 16	Last day for undergraduate students completing requirements for degrees at the end of Session 1 to submit *Application for Admission to Degree* forms
Thursday 17	Publication of provisional timetable for June/July examinations
Sunday 20	**May Recess ends**
Friday 25	Last day for students to advise of examination clashes

June

Tuesday 5	Publication of timetable for June/July examinations
Monday 11	Queen's Birthday — Public Holiday
Sunday 17	**Session 1 ends**
Monday 18	**Midyear Recess begins**
Tuesday 19	Examinations begin

July

Wednesday 4	Examinations end
Monday 16	Examination results mailed to students
Tuesday 17	Examination results displayed on University noticeboards *To Friday 20 July:* Students to amend enrolment programs following receipt of June examination results
Sunday 22	**Midyear Recess ends**
Monday 23	**Session 2 begins**

August

Friday 3	Last day for students to discontinue without failure subjects which extend over the whole academic year
Monday 27	**August Recess begins**
Tuesday 28	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

September

Sunday 2	**August Recess ends**
Wednesday 5	List of graduands for October graduation ceremonies published in *The Sydney Morning Herald*
Monday 10	Last day for notification of correction of details published in *The Sydney Morning Herald* on 5 September concerning October graduation ceremonies
Friday 14	Last day for undergraduate students to discontinue without failure subjects which extend over Session 2 only
Monday 24	*Confirmation of Enrolment* forms despatched to all students
Friday 28	Last day to apply to UCAC for transfer to another tertiary institution in New South Wales

October

Monday 1	Eight Hour Day — Public Holiday
Wednesday 3	Last day for acceptance of corrected *Confirmation of Enrolment* forms
Thursday 4	Publication of provisional examination timetable
Friday 5	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 12	Last day for students to advise of examination timetable clashes
Thursday 25	Publication of examination timetables

November

Sunday 4	**Session 2 ends**
Monday 5	**Study Recess begins**
Sunday 11	**Study Recess ends**
Monday 12	Examinations begin
Friday 30	Examinations end

December

Monday 17	Examination results mailed to students List of graduands in Medicine for February Graduation Ceremony published in *The Sydney Morning Herald*
Tuesday 18	Examination results displayed on University noticeboards
Tuesday 25	Christmas Day — Public Holiday
Wednesday 26	Boxing Day — Public Holiday

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Faculties other than Medicine and Military Studies

Session 1 (14 weeks)	4 March to 12 May
	May Recess: 13 May to 19 May
	20 May to 16 June
	Midyear Recess: 17 June to 21 July
Examinations	18 June to 3 July
Session 2 (14 weeks)	22 July to 25 August
	August Recess: 26 August to 1 September
	2 September to 3 November
	Study Recess: 4 November to 10 November
Examinations	11 November to 29 November

Faculty of Medicine

First and Second Years	As for other faculties
Third and Fourth Years	Term 1 (10 weeks) 21 January to 31 March Term 2 (9 weeks) 9 April to 12 May *May Recess:* 13 May to 19 May 20 May to 16 June Term 3 (9 weeks) 24 June to 25 August *August Recess:* 26 August to 1 September Term 4 (10 weeks) 2 September to 10 November
Fifth Year	Term 1 (8 weeks) 21 January to 17 March Term 2 (8 weeks) 25 March to 19 May Term 3 (8 weeks) 27 May to 21 July Term 4 (8 weeks) 29 July to 22 September Term 5 (8 weeks) 30 September to 24 November

January

Tuesday 1	Public Holiday (New Year)
Friday 11	Last day for acceptance of applications by office of the Admissions Section for transfer to another undergraduate course within the University
Monday 14	Last day for applications for review of results of annual examinations
Monday 28	Australia Day — Public Holiday

February

Monday 19	Enrolment period begins for second and later year undergraduate students and graduate students enrolled in formal courses

March

Monday 4	Session 1 begins — all courses except Medicine III, IV and V

April

Friday 5 to Monday 8	Easter — Public Holiday
Thursday 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 1983 the University had 18,376 students and over 3,600 staff who worked in more than eighty buildings. These figures include staff and students at Broken Hill (W.S. and L.B. Robinson University College), Duntroon (the Faculty of Military Studies) and Jervis Bay.

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', 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 44 members from the State Parliament, industry and commerce, agriculture, the trade unions, professional bodies, the staff, the students and the graduates of the University.

The Council meets six 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 eleven faculties are Applied Science, Architecture, Arts, Biological Sciences, Commerce, Engineering, Law, Medicine, Military Studies, Professional Studies and Science. In addition, the Board of Studies of the Australian Graduate School of Management (AGSM) and the Board of Studies in General Education 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 science and mathematics degree course.

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, Professor Ray Golding and Professor Athol Carrington, together with the Deans and the three heads of the administrative divisions.

General Administration

The administration of general matters within the University comes mainly within the province of the Registrar, Mr Ian Way, the Bursar, Mr Tom Daly, and the Property Manager Mr Peter Koller.

The Registrar's Division is concerned chiefly with academic matters such as the admission of students, and the administration of examinations as well as the various student services (health, employment, amenities, and counselling).

The Bursar's Division is concerned with the financial details of the day-to-day administration and matters to do with staff appointments, promotions, etc.

The Property division is responsible for the building program and the 'household' services of the University, including electricity, telephones, cleaning, traffic and parking control and maintenance of buildings and grounds.

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, as the faculties have their own rules for the conduct of open meetings.

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) are available from individual schools.

Co-operative Bookshop
Membership is open to all students, 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 3476.

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 450 men and women students, as well as tutorial and administrative staff members. Fees are payable on a session basis. Apply in writing to the Master, PO Box 24, Kensington, NSW 2033.

International House

International House accommodates 154 male and female students from Australia and up to thirty other countries. Preference is given to more senior undergraduates and graduate students. 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 220 graduates and undergraduates, without regard to race, religion, or sex. The College has its own resident tutors, and sponsors a wide range of sporting and social activities. 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 provides accommodation for 200 men and is open to students of all ages, backgrounds and beliefs. The College offers a comprehensive tutorial program along with a wide range of activities, professional orientation and opportunities to meet members of the University staff informally. Non-resident membership is available to male students who wish to participate in College activities and to make use of its facilities. The general spiritual care of the College has been entrusted to Opus Dei. 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 spiritual activities offered at Creston are entrusted to the Women's Section of Opus Dei. Enquiries: 36 High Street, Randwick 2031. Telephone (02) 398 5693.

Other Accommodation

Off-campus Accommodation

Students requiring other than College accommodation may contact the Housing Officer in the Chancellery, Room 148E for assistance 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. Accom

modation 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.

Special pamphlets on accommodation, lists of estate agents and hints on house-hunting are available on request.

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-eight clubs.

The Association office is situated on the 3rd floor, Squarehouse, E4, lower campus, and can be contacted on extension 2673. 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.

School and Faculty Associations

Many schools and faculties have special clubs with interests in particular subject fields. Enquire at the relevant Faculty or School Office for information.

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. See the **General Information** section of the Faculty Handbooks for details.

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.

Deputy Registrar (Student Services)

The Deputy Registrar (Student Services), Mr Peter O'Brien, and his Administrative Assistant, Mrs Anne Beaumont, are located on the first floor of the Chancellery.

They 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, 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 148E or by telephoning extension 2482 (general enquiries).

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 38 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 on the 3rd Floor, Squarehouse, E4, lower campus. The various services may be contacted by phone on the following extensions: Recreation Program 3271; Grounds Bookings 2235; Tennis Bookings 2617; Sports Association 2673.

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, and a 50-metre indoor heated swimming pool. 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 recreational program includes intramurals, teaching/coaching, camping. The Centre is located on the lower campus adjacent to High Street. The Supervisor at PERC may be contacted on extension 3271.

Student Counselling and Research Unit

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

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 to 5 pm on week days (up to 7 pm on some evenings). A 'walk-in' service for short interviews is available between 9 am and 5 pm. Appointments may be made by phoning extension 3685 or 3681 between 8.30 am and 5.30 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.

The Section is located in Undercroft Room LG05 in the Chancellery.

For further information, telephone as follows: careers and employment assistance 3259 or 3630; long vacation industrial training 2086.

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 extension 2679, 2678 or 2677 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.** All alumni of the University are eligible for Life 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.

A full-time President, elected each year by popular ballot, directs the entire administration of the Students' Union and its activities, assisted by a Secretary-Treasurer.

Other officers are the Education Vice-President who works towards the implementation of Students' Union education policy; the Welfare-Research Officer concerned with helping students with problems they may encounter in the University; the Electronic Media Officer; and the Director of Overseas Students who deals with specific problems these students may encounter while in Australia.

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.

10. Organization of Foundation Day.

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), the other is on the Second Floor of the Squarehouse (above the bar) at the bottom end of campus.

The University Library

The University libraries are mostly situated on the upper campus. The library buildings house the Undergraduate Library on Level 3, the Social Sciences and Humanities Library on Level 4, the Physical Sciences Library on Level 7 and the Law Library on Level 8. 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 Royal Military College, Duntroon, 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.

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

The University Union

The University Union provides the facilities students, staff and graduates require in their daily University life and thus an opportunity for them to know and understand one another through associations outside the lecture room, the library and other places of work.

The Union is housed in three buildings near the entrance to the Kensington Campus from Anzac Parade. These are the Roundhouse, the Blockhouse and the Squarehouse. 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 full range of facilities provided by the Union includes a cafeteria service and other dining facilities, a large shopping centre (including clothing shop and delicatessen); travel service; banking, pharmaceutical, optometrical and hairdressing facilities; showers; common, games, reading, meeting, music, practice, craft and dark rooms. The Union also has shops on Campus which cater for student needs, including art materials and calculators. The Union also operates various Food Service Points on the Upper Campus including the Sciences Cafeteria, Golf House and the Undercroft with a late night service in the Sciences Cafeteria. Photocopying, sign printing, and stencil cutting services are also available. The Union also sponsors special concerts (including lunchtime concerts) and conducts courses in many facets of the arts including weaving, photography, creative dance and yoga. Full information concerning courses is contained in a booklet obtainable from the Union's program department.

The University Union should not be confused with the Students' Union or Students' Representative Council as it is known in some other universities. This latter body has a representative function and is the instrument whereby student attitudes and opinions are crystallized and presented to the University and the community.

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 incomes 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
- Master's 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.

Tertiary students receiving an allowance, and prospective tertiary students, will be sent application forms in January 1984. Forms are also available from the Admissions Section *or* the Careers and Employment Section, *or* from the Director, Department of Education, 59 Goulburn Street, Sydney, NSW 2000 (telephone 218 8800). Continuing students should submit applications as soon as examination results are available. New students should do so as soon as they are enrolled. All students should apply by 31 March 1984, otherwise benefits will not be paid for the earlier months of the year.

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. Early in 1973 the Commonwealth Government 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.

From the same source students who are in extremely difficult financial circumstances may apply for assistance by way of a non-repayable 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 generous 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 the Deputy Registrar (Student Services), room 148E, in 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, the University may assist Aboriginal students with loans to meet some essential living expenses.

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. The University is engaged in consultations with groups and individuals for advice on the most effective ways of using the funds and has established a committee to advise the Vice-Chancellor in the matter.

All enquiries relating to these matters should be made at the office of the Deputy Registrar (Student Services), Room 148E, in 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 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 5 pm, Monday to Friday. During enrolment it is also open for some part of the evening.

Information may be obtained here about 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. 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.**

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.

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.

Details of the procedure to be followed by students seeking entry to first year undergraduate degree courses at the University may be obtained from the Student Enquiry Counter or the Universities and Colleges Admissions Centre.

An Adviser for Prospective Students, Mrs Fay Lindsay, is located in the Chancellery, 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 eighteen institutions in the State including the University of Wollongong and the three universities in the Sydney Metropolitan area (Macquarie University, the University of New South Wales and the University of Sydney) are required to lodge a single application form with the Universities and Colleges Admissions Centre, Challis House, 10 Martin Place,

Sydney 2000 (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 three universities and fifteen 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 proceeding directly from school to University 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.

Enrolment Procedures and Fees Schedules 1984

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 in which to pay fees from the office of the Deputy Registrar (Student Services) (Room 148E, 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 registration number be given accurately. Cash should not be sent through the mail.

2. New Undergraduate Enrolments

Persons who are applying for entry in 1984 must lodge an application for selection with the Universities and Colleges Admissions Centre, GPO Box 7049, Sydney 2001, by 1 October 1983.

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 through the appropriate school in accordance with the procedures set out in the current *Enrolment Procedures* booklet, available from the Student Enquiries Counter in the Chancellery and from School offices. Those 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 1983.

4. Restrictions Upon Re-enrolling

Students who in 1983 have infringed the rules governing re-enrolment should not attempt to re-enrol in 1984 but should follow the written instructions they will receive from the Registrar.

5. New Research Students

Students enrolling for the first time in graduate research degree courses will receive an enrolment form by post. They have two weeks from the date of offer of registration in which to lodge the enrolment form with the Cashier. Completion of enrolment after this time will incur a penalty (see section **16.** below).

6. Re-enrolling Research Students

Students undertaking purely research degree programs (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 registered for formal masters degree programs (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 thesis or project report are required to re-enrol by the end of the

second week of Session 1. Completion of enrolment after then 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 be permitted to be enrolled as a miscellaneous student in that subject.

(3) A student who is under exclusion from any course in the University may not be permitted to 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.

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 new students after the end of the second week of Session 1 (16 March 1984) except with the express approval of the Deputy Registrar (Student Services) and the Heads of the Schools concerned; no later year enrolments for courses extending over the whole year or for Session 1 only will be accepted after the end of the fourth week of Session 1 (30 March 1984) except with the express approval of the Deputy Registrar (Student Services) 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 (3 August 1984) except with the express approval of the Deputy Registrar (Student Services) and the Heads of the Schools concerned.

10. University of New South Wales and University Union Membership Card

All students enrolled in degree or diploma courses or as miscellaneous students, except those exempt from University Union fees under provisions of section **17.** below, are issued with a University of New South Wales and University Union Membership Card. This card must be carried during attendance at the University and shown on official request.

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

The card must be presented when borrowing from the University libraries, when applying for travel concessions, and when notifying a change of address. It must also be presented when paying fees on re-enrolment each year when it will be made valid for the year and returned. Failure to present the card could result in inconvenience in completing re-enrolment.

Life members of the University Union and those exempt from payment of University Union fees, if enrolled in degree or diploma courses or miscellaneous students use the University's fees receipt in place of the card when applying for travel concessions and when notifying a change of address. The University Library issues a library borrowing card on production of the fees receipt.

A student who loses a card must notify the University Union as soon as possible.

New students are issued with cards on enrolment if eligible.

New graduate students should complete an application for a card when they enrol unless they already possess one from previous study at the University. The card can be collected from the second floor of the University Union Blockhouse approximately three weeks after enrolment. The fees receipt may be used as necessary until the card is available.

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 complete their enrolment by paying their own fees.

A refund of fees 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 to the office of the Deputy Registrar (Student Services) (Room 148E, the Chancellery) for an extension of time 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 to the office of the Deputy Registrar (Student Services) (Room 148E, the Chancellery) for an extension of time, which may be granted in extenuating circumstances. Such applications must be made before the due date.

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 ceases to be entitled to the use of University facilities. Such students are not permitted to register 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 (27 April 1984). 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 (31 August 1984).

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.

University Union Entrance Fee

Payable on first enrolment $35

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, the Sports Association, or the Students' Union, 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 are current in 1983 and are therefore subject to an increase in 1984.

University Union annual subscription $101

Sports Association annual subscription $21

Students' Union Annual Subscription

Students enrolling in full-time courses $30
Students enrolling in part-time courses or as miscellaneous students $25

These two fees will be increased for 1984; the amounts have yet to be determined at the time of publication.

Miscellaneous Fund annual fee $35

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, the Sports Association, or the Students' Union, should make enquiries about the matter at the offices of those bodies, not at the office of the Deputy Registrar (Student Services) or at the Cashier's office.

(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 W. S. and L. B. Robinson University College and in the Faculty of Military Studies 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 Deputy Registrar (Student Services) 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 dean of the appropriate faculty and 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 Deputy Registrar (Student Services) 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 Deputy Registrar (Student Services) 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, 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 form available from the appropriate Course Authority.

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

(3) Enrolment in additional subjects

Applications for enrolment in additional subjects must be submitted by:

30 March 1984 for Session 1 only and whole year subjects;
17 August 1984 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 (20 April or 7 September)

(b) for whole year subjects, the end of the second week of Session 2 (3 August).

(5) Withdrawal from Course – 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 by the Student Records and Scholarships Office 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 (30 March 1984) 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 (20 April 1984) a refund of three-quarters of the Student Activities Fees paid will be made; if notice is given before the beginning of Session 2 (23 July 1984) 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 (7 September 1984) 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 (30 March or 17 August 1984) 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 (20 April or 7 September 1984) 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 Deputy Registrar (Student Services) to a student unable to notify the Student Records and Scholarships Office in writing by the times required provided evidence is supplied that the student has ceased attendance by those times.

(6) Acknowledgements

The Student Records and Scholarships Office 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 (20 April or 7 September) will be incorporated in the *Confirmation of Enrolment Program* notice forwarded to students on 30 April or 20 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.

(7) 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 Student Records and Scholarships Office.

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.

Students who withdraw from the first year of their course *are not* granted leave of absence and must again apply for a place through the Universities and Colleges Admissions Centre.

Course Transfers

Students wishing to transfer from one course to another must complete and submit an application form, obtainable from the office of the Admissions Section, the Chancellery, by Friday 13 January 1984.

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 1983 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 Univer-

sity 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.

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

Students must advise the Examinations Section (the Chancellery) of any clash in examinations. Final timetables indicating the dates, times, locations, and authorized aids 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

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 are included in the examination timetable (November/December only) and change of address forms are obtainable at the Student Enquiry Counter, the Chancellery. Forms can be accepted up to Friday 1 July for Session 1 results and Friday 2 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. Applications made more than seven days after the final examination in a subject will only be considered in exceptional circumstances.

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 Student Records (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 the Examinations Section to make special arrangements for their examinations, should contact Student Records as soon as the final timetable becomes available.

Use of Electronic Calculators

Where the use of electronic calculators has been approved by a faculty or school, examiners may permit their use in examinations. Authorized electronic calculators are battery operated with the minimum operations of addition, subtraction, multiplication and division and are of a type in common use by university students. They are not provided by the University, 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 requested to be in their places at least fifteen minutes before the commencement to hear announcements. The examination paper will be available for reading ten minutes before commencement.

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 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: use of unauthorized aids in an examination; submitting work for assessment knowing it to be the work of another person; improperly obtaining prior knowledge of an examination paper and using that knowledge in the examination; 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 a specified aid, 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.

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.

Restrictions upon Student 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 the 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.

Repeated Failure Rule

2. Students shall be required to show 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 their 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 examinations 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 Professsional 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 the program where the unit value for each subject in a course is defined as follows:

Faculty/Board of Studies	Minimum Requirement	Course	Unit Values (UV)
Applied Science	Half the program	3000-3220 4190-4220	One-session subjects: UV 1 Two-session subjects: UV 2
Architecture	Half the program	3270, 3330	Elective subjects: UV 0 All other subjects: appropriate UV corresponding to credit points*
		3320, 3360, 3380	All subjects: UV equal to the allocated hours* Elective subjects: UV 0 All other subjects: UV equal to the allocated hours*
Arts	18 first-level credit points	3400, 3420	
Biological Sciences		3430	Science subjects: appropriate UV* Arts subjects: • 6 credit points = UV 1 • 12 credit points = UV 2

*For details see the appropriate Faculty Handbook.

Faculty/Board of Studies	Minimum Requirement	Course	Unit Values (UV)
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, 3660, 3680, 3700	5.061: UV 0 One-session subjects: UV 1 Two-session subjects: UV 2
	Half the program including Mechanics of Solids or Mathematics I	3620, 3730	All subjects: UV equal to the allocated hours*
	Half the program including Physics I or Mathematics I	3640, 3720	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 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 General Studies: UV 1
Military Studies	Half the program	BA, BSc	All subjects: UV 1
		BE	All subjects: appropriate weighted mark*
Professional Studies	Half the program	4030, 4040	All subjects: UV 1
		4070-4080	All subjects: appropriate UV* One General Studies elective: UV1
Science	Half the program	3910, 3950	All subjects: appropriate UV* General Studies: UV 1
Science and Mathematics	2 units	3970	All subjects: appropriate UV* One General Studies elective: UV 1

*For details see the appropriate Faculty Handbook.

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 first Tuesday 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 Enrolment Details form 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** and **3970** 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 1 September for those completing requirements at the end of Session 1, or before 28 February 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 December.

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 second Wednesday in September.

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 second Wednesday in March.

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

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 on 30 April and 24 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 Registrar's Division 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 25 November, 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 Alumni and Ceremonials Section, Room 148E, the Chancellery (phone extension 2998).

Further Information

Lost Property

All enquiries concerning lost property should be made to the Superintendent on extension 3892 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.

Vice-Chancellor's Official Welcome to New Students

All students initially enrolling in the University are officially welcomed by the Vice-Chancellor and Principal at the following times:

Faculties of Architecture, Arts, Biological Sciences, Commerce, Law:

Tuesday 28 February 1984
9 am in the Clancy Auditorium

Faculties of Applied Science, Engineering, Medicine, Professional Studies, Science, and the Board of Studies in Science and Mathematics:

Tuesday 28 February 1984
11 am in the Clancy Auditorium

Meeting for Parents of New Students

Friday 2 March 1984
7.30 pm in the Clancy Auditorium

Foreword

The importance of the Applied Science in this University's development has always been recognized, and is especially referred to in our Act of Incorporation.

Undergraduate courses well established in the Faculty are: Applied Geography (including Applied Economic Geography, Applied Physical Geography and Human and Physical Resources), Applied Geology, Chemical Engineering (including Biological Process Engineering and Fuel Engineering), Industrial Chemistry, Food Technology, Metallurgy (including Ceramic Engineering and Metallurgical Process Engineering), Mining Engineering, Textile Technology (including Textile Chemistry, Textile Physics, Textile Engineering and Textile Manufacture) and Wool and Pastoral Sciences. The Faculty is concerned with a variety of research programs and many of the Faculty's research contributions have achieved international recognition.

It is hoped that students who enter the Faculty will share the enthusiasm and the dedication of those who have taken part in its development. It is of the greatest importance that students should acquire, from the very beginning, the right approach to their studies, and that they should achieve a proper balance between their work and their extra-curricular activities.

In addition to this handbook, pamphlets and brochures issued in conjunction with the enrolment period and Orientation Week are available. These should be consulted, together with the Calendar, for further information.

It is hoped that this handbook will be of value to present and prospective students in the Faculty and to employers.

M. Chaikin
Dean
Faculty of Applied Science

Faculty Information

Who to Contact

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

Mr R. Starr, Senior Administrative Officer, Faculty of Applied Science. Room 123, Sir Robert Webster Building. Tel. (02) 662 3401.

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

Applied Geology Mr G. Baldwin, Senior Administrative Officer. Room 810, Applied Science Building. Tel. 662 2336

Chemical Engineering and Industrial Chemistry Mr J. Gatenby, Senior Administrative Officer.
Room 319, Applied Science Building. Tel. 662 2404.

Food Technology Mr R. Greenwood, Administrative Officer. Room 411, Applied Science Building. Tel. 662 3816.

Geography Mr P. Dunkley, Administrative Assistant.
Room G10, Geography and Surveying. Tel. 662 2084.

Metallurgy Administrative Officer.
Room 110B, Metallurgy Building. Tel. 662 2351.

Mining Engineering Mr R. Rolls, Administrative Assistant.
Room 51B, Main Building. Tel. 662 2912.

Textile Technology Mr R. Starr, Senior Administrative Officer.
Room 123, Sir Robert Webster Building. Tel. 662 3401.

Wool and Pastoral Sciences Mr J. Lawrence, Administrative Officer.
Room 102, Wool and Pastoral Sciences Building. Tel. 662 2288.

Faculty of Applied Science Enrolment Procedures

All students re-enrolling in 1984 should obtain a copy of the free booklet *Enrolment Procedures 1984* 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, Physical Sciences Library and the Undergraduate Library.

The Biomedical Library

This library serves the information needs of the staff and students of the Schools of Food Technology and Wool and Pastoral Sciences for life sciences aspects of their study and research.

Biomedical Librarian George Franki

The Physical Sciences Library

This library, situated on Levels 6 and 7 of the Library tower, caters for the information needs of staff, graduate students and senior 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 always available on Level 7 to assist readers with their enquiries.

Physical Sciences Librarian Marian Bate

The Undergraduate Library

This library caters for the library needs of first and second year students and other groups where large numbers require mass teaching.

The Undergraduate Library provides a reader education program and reader assistance service aimed at teaching students the basic principles of finding information.

Services of particular interest to undergraduates and academic staff are:

- **The Open Reserve Section,** housing books and other material which are required reading.

- **The Audio-Visual Section,** containing cassette tapes, mainly lectures and other spoken word material. The Audio-Visual Section has wired study carrels and cassette players for student use.

Undergraduate Librarian Pat Howard

The Bachelor of Social Science Degree Course (3420)

The Bachelor of Social Science (BSocSc) is a degree 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. 662 2248.

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 Applied Geology, Chemical Engineering and Industrial Chemistry, Food Technology, Geography, Metallurgy, Mining Engineering, Textile Technology and Wool and Pastoral Sciences. 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 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, Metallurgical Process Engineering and Mining 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 I; Class II Division I; and Class II Division II.

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 Technology; in Industrial Chemistry by the School of Chemical Engineering and Industrial Chemistry; and in Metallurgy and Ceramic Engineering by the School of Metallurgy.

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) and BSc(Eng) degree courses, but in both

cases 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.

BSc(Eng) Degree Courses With Partial Full-time Attendance

BSc(Eng) degree courses may be completed by a combination of full-time and part-time study. The first two stages are to be completed part-time; in the following two years students complete Years 2 and 3 of the corresponding full-time course; and in the fifth stage a special program is prepared. Full details are set out below under the Schools which provide the courses.

General Studies Electives

The following summary of the changes in General Studies requirements which took effect in the 1983 academic year is provided for the benefit of continuing students.

Previous Requirement		*New Requirement*	
4-42	hour electives or equivalent	3-56	hour electives or equivalent
3-42	hour electives or equivalent	2-56	hour electives or equivalent
2-42	hour electives or equivalent	1½-56	hour electives or equivalent
1½-42	hour electives or equivalent	1-56	hour electives or equivalent

School of Applied Geology

Head of School
Professor G. J. S. Govett

Senior Administrative Officer
Mr G. J. Baldwin

Geology is 'the science of the earth' and is concerned with the nature and evolution of our planet. Resource geology is concerned with the exploration for and exploitation of minerals and energy, and other aspects of the science that form a foundation on which much of mankind's well-being is based. Thus geology has both an applied, professional function as well as being a scientific discipline. The structure and syllabus of the BSc degree courses in Applied Geology and Mining Geology are designed to prepare graduates for employment in some field of resource geology.

Training to meet this objective demands a thorough understanding of basic geological principles. Accordingly, in the early part of the course in Applied Geology students receive instruction in standard fundamental geological subjects. As the course progresses, increasing emphasis is placed on practical applications in the geology of minerals and energy, on engineering and environmental geology and on exploration techniques including geochemical and geophysical methods. In Session 1 of Year 4 students choose between tuition strands of mineral resources, sedimentary basin resources, engineering and environmental geology, or geophysics. Session 2 of Year 4 is devoted to field and laboratory work on a specialized research project.

Year 1 of the course in Mining Geology is common to that in Applied Geology. Years 2 to 4 allow for greater emphasis on the engineering aspects of both underground and open-cut mining techniques while still providing a good basis of geological principles. Session 2 of Year 4 is devoted to a research project in mining geology either within the School of Applied Geology or the School of Mining Engineering.

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 read 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 section.

3000
Applied Geology — Full-time
Bachelor of Science
BSc

Year 1		**Hours per week** S1	S2
1.001 1.011	Physics I *or* Higher Physics	6	6
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
10.001 10.011 10.021B 10.021C	Mathematics I *or* Higher Mathematics I *or* General Mathematics IB *and* General Mathematics IC	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

		Hpw S1	S2
25.211	Earth Materials I*	6	0
25.212	Earth Environments I**	6	0
25.221	Earth Materials II***	0	6
25.223	Earth Physics*	0	6
25.2261	Mathematical Geology I	0	3
	General Studies Elective	2	2
		14	17

*Field work of up to 1 day 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 8 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

25.311	Earth Materials III	6	0
25.321	Earth Materials IV*	0	6
25.312	Earth Environments II**	6	0
25.333	Exploration Geophysics	3	2
25.3162	Mathematical Geology II	3	0
25.314	Mineral and Energy Resources I****	6	0
25.324	Mineral and Energy Resources II§	0	6
25.325	Engineering and Environmental Geology***	0	6
25.3261	Geochemical Analytical Techniques	0	2
25.3271	Advanced Structural Geology***	0	2
	General Studies Elective	2	2
		26	26

*Field work of up to 6 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.
****Field work of up to 4 days is a compulsory part of the subject.
§Field work of up to 1 day 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
7.214	Mine Economics and Planning	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

or

D. Geophysics strand**, consisting of

		S1§ A	B
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 strand.

3145
Mining Geology — Full-time (New Course)

Bachelor of Science
BSc

Year 1

		Hours per week S1	S2
1.001	Physics or		
1.011	Higher Physics	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

5.010	Engineering A	6	0
5.0201	Engineering Dynamics	0	3
5.030	Engineering C	6	0
5.171	Mechanics of Solids I	0	3
7.142	Mine Development	1	1
25.211	Earth Materials I*	6	0
25.221	Earth Materials II**	0	6
25.223	Earth Physics*	0	6
25.2261	Mathematical Geology I	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 8 days is a compulsory part of this subject.
***Field work of up to 5 days is a compulsory part of this subject.

Year 3

7.113	Mining Methods	2	2
7.123	Geomechanics	4	4
7.213	Mine Surveying	2	0
25.314	Mineral and Energy Resources I*	6	0
25.3162	Mathematical Geology II	3	0
25.324	Mineral and Energy Resources II**	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 4 days is a compulsory part of this subject.
**Field work of up to 1 day is a compulsory part of this subject.
***Field work of up to 3 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*

		Hpw S1	S2
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 School of Applied Geology.
††Offered by the School of Mining Engineering.

School of Chemical Engineering and Industrial Chemistry

Head of School
Professor D. L. Trimm

Senior Administrative Officer
Mr J. R. Gatenby

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.

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.

General Studies Electives

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

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 (exclusing 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 I *or*		
1.011	Higher Physics I	6	6
2.121	Chemistry IA *and*		
2.131	Chemistry IB *or*	6	6
2.141	Chemistry IM	6	6
5.010	Engineering A	0	6
5.030	Engineering C (includes 48.001 Introduction to Chemical Industry)	6	0
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		24	24

Year 2

2.002A	Physical Chemistry	6	0
2.002B	Organic Chemistry	2	4
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.021	Chemical Engineering IA	5	0
48.022	Chemical Engineering IB	1	4
48.311	Fuel Engineering I*	2	2
48.121	Corrosion in Chemical Industry	0	2
48.122	Instrumental Analysis	0	6
	Two General Studies Electives	4	4
		24	26

*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
8.112	Structures	3	0
10.032	Mathematics	2	2
48.031	Chemical Engineering IIA	7	0
48.032	Chemical Engineering IIB	0	6
48.033	Chemical Engineering IIC	0	6
48.036	Chemical Engineering Laboratory I	2	2
48.135	Thermodynamics	3	0
48.136	Reactor Design I	1	2
48.163	Instrumentation and Process Control I	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 IIJ	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.

		Hpw S1	S2
Year 4			
48.041	Chemical Engineering IIIA	4	0
48.042	Chemical Engineering IIIB	4	0
48.043	Chemical Engineering IIIC	5	0
48.044	Chemical Engineering Laboratory II	3	0
48.047	Chemical Engineering IIID Project*	0 1	6 11
		17	17

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

Plus *one* of the following:

48.048	Advanced Chemical Engineering	6	6
48.211	Biological Process Engineering	6	6
48.331	Fuel Engineering III	6	6
48.046	Chemical Engineering Projects (additional)	6	6

Chemical Engineering — Subjects and Units

		Hours per week S1	S2
48.001	Introduction to Chemical Industry	2	0
48.021	**Chemical Engineering IA**		
	Unit 1 Flow of Fluids	2	0
	2 Material and Energy Balances	2	0
	3 Dimensions and Dimensional Analysis	1	0
		5	0
48.022	**Chemical Engineering IB**		
	Unit 1 Heat Transfer I	0	2
	2 Computations I	1	1
	3 Pumps and Pumping	0	1
		1	4
48.023	**Chemical Engineering Science I** — (Applicable to Science programs) Consists of: 48.021 *and* 48.022	6	4
48.024	**Chemical Engineering Principles I** (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
48.031	**Chemical Engineering IIA**		
	Unit 1 Mass Transfer (theory)	2	0
	2 Heat Transfer II (theory)	1	0
	3 Plant Layout	1	0
	4 Process Engineering	1	0
	5 Surface Separation Processes	1	0
	6 Economics I	1	0
		7	0
48.032	**Chemical Engineering IIB**		
	Unit 1 Solids Handling	0	1
	2 Computations II	0	2
	3 Engineering Thermodynamics	0	1
	4 Economics II	0	1
	5 Safety and Failure Tolerance	0	1
		0	6
48.033	**Chemical Engineering IIC**		
	Unit 1 Mass Transfer Design	0	1½
	2 Heat Transfer II (Design)	0	1
	3 Process Vessels	0	1½
	4 Fluid-Particle Systems	0	2
		0	6
48.036	**Chemical Engineering Laboratory I**		
	Unit 1	2	0
	2	0	2
		2	2
48.037	**Chemical Engineering Science II** (Applicable to Science programs) Consists of: Units 1, 2 and 5 of 48.031, Unit 2 of 48.032, Unit 4 of 48.033, 48.135 *and* 48.136	7	6

		Hpw S1	S2
48.038	Chemical Engineering Principles II (Applicable to Mathematics programs) Consists of: Units 1, 2 and 5 of 48.031 *and* Unit 4 of 48.033	4	2
48.039	Chemical Engineering IIJ	3	3
48.041	Chemical Engineering IIIA		
	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 IIIB		
	Unit 1 Process Dynamics and Control I	3	0
	2 Optimization	1	0
		4	0
48.043	Chemical Engineering IIIC		
	Unit 1 Design Workshop	3	0
	2 Industrial Pollution Control	2	0
		5	0
48.044	Chemical Engineering Laboratory II	3	0
48.040	Chemical Engineering Project	1	11
48.047	Chemical Engineering IIID		
	Unit 1 Management	0	2
	2 Process Engineering II	0	2
	3 Process Dynamics and Control II	0	2
		0	6
48.048	Advanced Chemical Engineering		
	Unit 1 Petroleum and Reservoir Engineering	3	3
	2 Mineral Chemistry	3	3
		6	6
48.135	Thermodynamics	3	0
48.136	Reactor Design I		
	Unit 1 Kinetics of Rate Processes	1	0
	2 Reaction Engineering	0	2
		1	2
48.163	Instrumentation and Process Control	0	3
48.211	Biological Process Engineering	6	6
48.240	Biological Process Engineering Project	1	11

		Hpw S1	S2
48.311	Fuel Engineering I*		
	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 II*		
	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 III		
	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 I
Stages 3 and 4 or Year II
Stages 5 and 6 or Year III
Stage 7 or Year IV

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.

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 I *or*		
1.011	Higher Physics I	6	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		12	12

Stage 2

2.121	Chemistry IA *and*		
2.131	Chemistry IB *or*	6	6
2.141	Chemistry IM	6	6
5.010	Engineering A	0	6
5.030	Engineering C (Includes 48.001 Introduction to Chemical Industry)	6	0
		12	12

Stage 3

2.002A	Physical Chemistry	6	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.122	Instrumental Analysis	0	6
	General Studies Elective	2	2
		12	12

Stage 4

2.002B	Organic Chemistry	2	4
48.021	Chemical Engineering IA	5	0
48.022	Chemical Engineering IB	1	4
48.121	Corrosion in Chemical Industry	0	2
48.311	Fuel Engineering I*	2	2
	General Studies Elective	2	2
		12	14

*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 IIA	7	0
48.032	Chemical Engineering IIB	0	6
48.135	Thermodynamics	3	0
48.136	Reactor Design I	1	2
48.163	Instrumentation and Process Control	0	3
		13	13

Stage 6

		Hpw S1	S2
6.854	Electrical Power Engineering	0	3
8.112	Structures	3	0
48.033	Chemical Engineering IIC	0	6
48.036	Chemical Engineering Laboratory I	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 IIJ	3	3
48.321	Fuel Engineering II	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 I	6
or		
1.011	Higher Physics	6
2.121	Chemistry IA *and*	6
2.131	Chemistry IB	
or		
2.141	Chemistry IM	6
10.001	Mathematics I	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.

		Hpw S1	S2
Year 2			
2.002A	Physical Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
2.002B	Organic Chemistry	2	4
1.9222	Electronics	3	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.122	Instrumental Analysis	0	6
48.125	Industrial Chemistry IA	4	0
48.126	Industrial Chemistry IB	1	3
	General Studies Elective	2	2
		22	25
Year 3			
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 I	1	2
48.137	Industrial Chemistry IIA	3	0
48.138	Industrial Chemistry IIB	0	3
48.139	Experimental Design	0	2
48.163	Instrumentation and Process Control I	0	3
48.171	Chemistry of High Temperature Materials	0	2
48.172	Instrumental Analysis II	3	0
48.403	Polymer Science	3	3
	General Studies Elective	2	2
		24	22
Year 4*			
18.121	Production Management	3	3
42.114	Fermentation Processes	0	2
48.124	Applied Kinetics	2	0
48.134	Applied Thermodynamics	2	0
48.165	Laboratory Automation Science	3	0
48.174	Seminars	2	2
48.194	Project	8	16
	General Studies Elective	2	2
		22	23

Plus *two* 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
48.404	Advanced Polymer Science	2

*Only two of these are 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 I *or*	6
1.011	Higher Physics I	6
2.121	Chemistry IA *and*	6
2.131	Chemistry IB *or*	
2.141	Chemistry IM	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I	6
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

		S1	S2
2.002A	Physical Chemistry	6	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
48.122	Instrumental Analysis	0	6
	General Studies Elective	2	2
		12	12

Stage 4

1.9222	Electronics	3	0
2.002B	Organic Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
48.125	Industrial Chemistry IA	4	0
48.126	Industrial Chemistry IB	1	3
		14	9

Stage 5

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

		Hpw S1	S2
Stage 6			
2.030	Organic Chemistry	6	0
48.113	Chemistry of Industrial Processes	3	3
48.163	Instrumentation and Process Control I	0	3
48.403	Polymer Science	3	3
		12	9

Professional Electives in Course 3040 Chemical Engineering

Biological Process Engineering

The Department of Biological Process Engineering 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 48.211 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 IIJ in Year 3 and 48.048 Advanced Chemical Engineering 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 II in Year 3 and 48.331 Fuel Engineering III 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 (U.K.).

School of Food Technology

Head of School
Professor R. A. Edwards

Administrative Officer
Mr R. J. Greenwood

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 man's 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 School of Food Technology 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	Physics I *or*		
1.021	Introductory Physics I	6	6
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I *or*		
10.021B	General Mathematics IB *and*	6	6
10.021C	General Mathematics IC		
17.031	Biology A	6	0
17.041	Biology B	0	6
		24	24

Year 2

2.002A	Physical Chemistry	0	6
2.002B	Organic Chemistry	0	6
2.002D	Analytical Chemistry	0	6
38.122	Man and Food	1	0
38.421	Food Engineering I	0	3
38.521	Introductory Nutrition	3	0
41.101	Introductory Biochemistry	12	0
44.143	Microbiology AS	10	0
	General Studies Elective	0	4
		26	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 I	3	0
38.431	Food Engineering II	3	0
	General Studies Elective	0	4
		27	23

Year 4

		Hpw S1	S2
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.

		Hours per week S1	S2
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
38.341	Food Microbiology II	0	6
38.344	Yeast Technology	0	3
38.443	Food Engineering III	6	0
38.541	Advanced Nutrition	3	0
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 concur-

rently 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 I *or*		
1.021	Introductory Physics I	6	6
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I† *or*	6	6
10.021B	General Mathematics IB *and*		
10.021C	General Mathematics IC	6	6
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

2.002B	Organic Chemistry	0	6
2.002D	Analytical Chemistry	0	6
41.101	Introductory Biochemistry	12	0
		12	12

Stage 4

2.002A	Physical Chemistry	0	6
38.122	Man and Food	1	0
38.421	Food Engineering I	0	3
38.521	Introductory Nutrition	3	0
44.143	Microbiology AS	10	0
	General Studies Elective	0	4
		14	13

		Hpw S1	S2
Stage 5			
2.043L	Chemistry and Enzymology of Foods	6	6
10.301	Statistics SA	2	2
38.135	Food Quality Assessment	0	3
38.431	Food Engineering II	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 I	3	0
		16	8

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 man's 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 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 expected 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. Students need a battery-operated calculator. It is also 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.

3010
Applied Geography — Full-time Course

Bachelor of Science
BSc

Applied Physical Geography

Year 1

		Hours per week S1	S2
10.021B	General Mathematics IB *and*	6	6
10.021C	General Mathematics IC *or*		
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
17.031	Biology A	6	0
17.041	Biology B	0	6
25.110	Earth Materials and Processes†	6	0
25.120	Earth Environments and Dynamics†	0	6
27.111	Applied Physical Geography I*	5	5
27.641	Data Processing Systems	1	1
		24	24

†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.

*Up to 3 days field work, equivalent to 24 tutorial hours, is an essential part of the subject.

Year 2

		Hpw S1	S2
2.121	Chemistry IA *or*	6	0
2.111	Introductory Chemistry	6	0
2.131	Chemistry IB	0	6
27.162	Geographical Statistics and Computing	4	2
27.172	Environmental Measurements*	6	6
	General Studies Elective	2	2
	and *either*		
25.211	Earth Materials I *and*	6	0
25.221	Earth Materials II†	0	6
	or any two of the following (one each session)		
43.111	Flowering Plants	6	0
43.101	Introductory Genetics	0	6
43.122	Plant Physiology	0	6
45.152	Population and Community Ecology‡	6	0
45.201	Invertebrate Zoology	0	6
45.301	Vertebrate Zoology	6	0
		24	22

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

†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.

Year 3

27.133	Pedology*	5	0
27.143	Biogeography*	0	5
27.153	Climatology	0	5
27.163	Methods in Physical Geography	1	1
27.1711	Introduction to Remote Sensing	3	0
27.183	Geomorphology*	5	0
27.193	Environmental Impact Assessment	1½	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 any two of the following (one each session)		
27.1712	Remote Sensing Applications‡	0	3
43.142	Environmental Botany	6	0
43.112	Taxonomy and Systematics§	0	6
43.152	Plant Community Ecology	0	6
43.162	The Plant Kingdom§	0	6
45.121	Evolutionary Theory	6	0
45.152	Population and Community Ecology†	6	0
45.302	Vertebrate Zoogeography	0	6
		20½	21
		or	
		23½	19

‡Prerequisites for 27.1712 are *either* 27.1711 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.

		Hpw S1	Hpw S2
Year 4			
27.194	Assessment and Management of Physical and Biological Resources*	12	0
27.504	Project†	10	16
27.514	Practical Applications in Geography	0	3
		22	19

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

†Includes scheduled tutorials of one hour per week in Session 1 and two hours per week in Session 2.

Applied Economic Geography

Year 1		Hours per week S1	Hours per week S2
10.021B 10.021C	General Mathematics IB *and* General Mathematics IC *or*	6	6
10.001 10.011	Mathematics I *or* Higher Mathematics I	6	6
15.001	Microeconomics I	3½	0
15.011	Macroeconomics I	0	3½
27.611	Applied Economic Geography I*	5	5
27.641	Data Processing Systems	1	1
54.1002	Power and Democracy in Australia	3	0
54.1004	Government in the Modern World	0	3
		18½	18½

*Three days field work, equivalent to 24 tutorial hours, is an essential part of the subject.

Year 2			
15.002	Microeconomics II *or*	4	0
15.072	Applied Microeconomics†	4	0
15.042	Macroeconomics II *or*	0	4
15.062	Applied Macroeconomics†	0	4
27.612	Applied Economic Geography IIA*	5	0
27.622	Applied Economic Geography IIB	0	5
27.632	Geographic Data Analysis II	4	4
27.642	Mathematical Methods for Spatial Analysis§	3	3
27.662	Urban Systems *or*	3	0
27.1711	Introduction to Remote Sensing**	3	0
27.672	Transport and Land Use	0	3
54.2008	Public Policy Making	0	3
		19	22

*Three days field work, equivalent to 24 tutorial hours, is an essential part of the subject.

†May be taken in either Session 1 or Session 2.

**Enrolment in this subject is dependent on approval by the Head of School.

§Subject to availability of staff.

		Hpw S1	Hpw S2
Year 3			
27.613	Applied Economic Geography IIIA	5	0
27.623	Applied Economic Geography IIIB*	0	5
27.633	Geographic Data Analysis III	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 III	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
15.082	Labour Economics	3	0
15.083	Public Finance	0	3
15.093	Public Sector Economics	3	0
15.143	Microeconomics III	0	4
15.163	Industrial Organisation and Policy	3	0
27.1712	Remote Sensing Applications††	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§	5	0
27.773	Spatial Aspects of the Housing Market†	5	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.

§Not offered in 1984.

††27.1711 is a prerequisite for this subject in the Applied Economic Geography program.

Year 4			
27.504	Project*	10	16
27.514	Practical Applications in Geography	0	3
27.624	Geographic Thought and Perspectives	3	0
27.644	Seminars in Applied Geography	4	0
		17	19

*Includes scheduled tutorials of one hour per week in Session 1 and two hours per week in Session 2.

Human and Physical Resources

Year 1

		Hours per week S1	S2
10.021B	General Mathematics IB	6	0
10.021C	General Mathematics IC	0	6
27.111	Applied Physical Geography I*	5	5
27.611	Applied Economic Geography I*	5	5
27.641	Data Processing Systems	1	1
and *either*			
15.001	Microeconomics I	3½	0
	and		
15.011	Macroeconomics I	0	3½
or			
17.031	Biology A *and*	6	0
17.041	Biology B	0	6
or			
25.110	Earth Materials and Processes**	6	0
	and		
25.120	Earth Environments and Dynamics**	0	6
		20½/23	20½/23

*Up to 3 days field work, equivalent to 24 tutorial hours, is an essential part of this 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.

Year 2

27.162	Geographical Statistics and Computing	4	2
27.172	Environmental Measurements*	6	6
27.432	Computer Mapping and Data Display	3	0
27.622	Applied Economic Geography IIB	0	5
27.662	Urban Systems	3	0
and *either*			
15.062	Applied Macroeconomics†	0	4
15.072	Applied Microeconomics†	4	0
15.212	Managerial Economics	4	0
or			
25.211	Earth Materials I	6	0
	and		
25.221	Earth Materials II§	0	6
or two of the following			
43.101	Introductory Genetics	0	6
43.111	Flowering Plants	6	0
45.201	Invertebrate Zoology	0	6
45.301	Vertebrate Zoology	6	0
		20/22	17/19

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

†May be taken in either Session 1 or Session 2.

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

Year 3

		Hpw S1	S2
27.1711	Introduction to Remote Sensing	3	0
27.423	Environmental Impact Evaluation	4	4
27.433	Geographic Data Analysis	3	3
plus *four of the following subjects*†§			
27.133	Pedology*	5	0
27.143	Biogeography*	0	5
27.153	Climatology	0	5
27.1712	Remote Sensing Applications	0	3
27.183	Geomorphology*	5	0
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	5	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
or two of†			
43.112	Taxonomy and Systematics§	0	6
43.142	Environmental Botany	6	0
43.152	Plant Community Ecology	0	6
43.162	The Plant Kingdom§	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.

Year 4

27.494	Assessment of Human and Physical Resources*	12	0
27.504	Project**	10	16
27.514	Practical Applications in Geography	0	3
		22	19

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

**Includes scheduled tutorials of one hour per week in Session 1 and two hours per week in Session 2.

Geography in Other Faculties

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

School of Metallurgy

Head of School
Vacant

The School of Metallurgy consists of the Departments of Chemical and Process Metallurgy, Physical and Industrial Metallurgy, Materials, and Ceramic Engineering. It offers courses in Metallurgy, Metallurgical Process Engineering and Ceramic Engineering.

Metallurgy and Metallurgical Process 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 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 metallurgy have been designed to prepare students for employment in metallurgical industries and research institutions, and involve a general training in basic sciences and engineering. These fundamental principles are then extended to cover studies of the extraction, refining, working, fabrication and use of metals. There are three undergraduate courses, two full-time in Metallurgy and in Metallurgical Process Engineering, leading to the award of the BSc and the BE degree respectively; and one part-time in Metallurgy, leading to the award of the BSc(Tech) degree. The aim of the BE degree course is to prepare graduates for employment in the mineral, metallurgical and manufacturing industries as metallurgical process engineers.

The BSc and BE degree courses are almost identical up to Year 3 and students enrolled in either of these courses may transfer from one to the other up to this point without loss of standing.

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 Metallurgists (London). Further details about membership of these institutes, the Australasian Institute of Metals and the undergraduate Metallurgical Society of the University, all of which students are encouraged to join, may be obtained from the Head of the School. It is expected that submissions to the Institution of Engineers for recognition of the Bachelor of Engineering degree course will meet with success.

General Studies Electives

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

3120
Metallurgy — Full-time Course
Bachelor of Science
BSc

Students in this course attend the University for twenty-eight weeks over two sessions from March to November (excluding examinations and recesses).

Students are required, before graduation, to have gained at least sixteen weeks approved industrial experience, and to have submitted satisfactory reports on the work done to comply with this requirement. Industrial experience is normally obtained during the long vacations at the end 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 / 1.011	Physics I *or* Higher Physics I	6	6
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	6	6
Plus either:			
5.010	Engineering A* *and*	0	6
5.030	Engineering C†	6	0
or			
25.110	Earth Materials and Processes *and*	6	0
25.120	Earth Environments and Dynamics	0	6
		24	24

*This subject includes 4.001 Introduction to Materials Science.
†This subject includes 4.002 Introduction to Metallurgical Engineering.

Year 2

		Hpw S1	S2
2.002A	Physical Chemistry	6	0
4.302	Chemical and Extraction Metallurgy I	3	3
4.402	Physical Metallurgy I	6	6
4.502	Mechanical Metallurgy	4	3
4.602	Metallurgical Engineering I	0	5
4.802	Metallurgical Physics	0	2
10.031	Mathematics	2	2
5.010	Engineering A† *and*	2	0
5.030	Engineering C† *or*	0	2
25.523	Mineralogy	2	2
	General Studies Elective	2	2
		25	25

†Part only.

Year 3

4.303	Chemical and Extraction Metallurgy II	5	5
4.403	Physical Metallurgy II	9	9
4.613	Metallurgical Engineering IIA	3	0
4.703	Materials Science	0	3
4.813	Mathematical Methods	3	3
6.854	Electrical Power Engineering	0	3
7.023	Mineral Process Engineering	2	0
	General Studies Elective	2	2
		24	25

Year 4

4.024	Metallurgy Project*	6	3
4.054	Metallurgy Seminar	2	2
4.314	Chemical and Extraction Metallurgy IIIA	4½	0
4.324	Chemical and Extraction Metallurgy IIIB	0	4½
4.404	Physical Metallurgy III	7½	4½
4.504	Mechanical and Industrial Metallurgy	3	9
	General Studies Elective	2	2
		25	25

*Project includes three weeks' laboratory work during Midyear Recess

3180
Metallurgical Process Engineering — Full-time Course

Bachelor of Engineering
BE

Attendance and Industrial Training requirements are as listed in the Bachelor of Science degree course.

Year 1

		Hours per week S1	S2
1.001	Physics I *or*		
1.011	Higher Physics I	6	6
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
5.010	Engineering A‡	0	6
5.030	Engineering C†	6	0
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		24	24

‡Includes 4.001 Introduction to Material Sciences.

†Students in Metallurgical Process Engineering include 4.002 Introduction to Metallurgical Engineering in 5.030.

Year 2

2.002A	Physical Chemistry	6	0
4.302	Chemical and Extraction Metallurgy I	3	3
4.402	Physical Metallurgy I	6	6
4.502	Mechanical Metallurgy	4	3
4.602	Metallurgical Engineering I	0	5
4.802	Metallurgical Physics	0	2
10.031	Mathematics	2	2
25.523	Mineralogy	2	2
	General Studies Elective	2	2
		25	25

Year 3

4.303	Chemical and Extraction Metallurgy II	5	5
4.433	Physical Metallurgy IIC	9	6
4.613	Metallurgical Engineering IIA	3	0
4.623	Metallurgical Engineering IIB	0	4
4.813	Mathematical Methods	3	3
6.854	Electrical Power Engineering	0	3
7.313	Minerals Engineering Processes	3	3
	General Studies Elective	2	2
		25	26

		Hpw S1	S2
Year 4			
4.054	Metallurgy Seminar	2	2
4.314	Chemical and Extraction Metallurgy IIIA	4½	0
4.504	Mechanical and Industrial Metallurgy	3	9
4.604	Metallurgical Engineering III	8	7
4.624	Metallurgical Engineering Project*	3	3
	General Studies Elective	2	2
		22½	23

Plus any combination of the following electives giving a total of at least 63 hours over the year (28 weeks):

1.9222	Electronics	3	0
4.414	Physical Metallurgy IIIA	4½	0
7.314	Mineral Process Technology	3	3
15.501	Introduction to Industrial Relations	2	0
48.032	Chemical Engineering IIB —		
	Unit 1 Solids Handling	0	1
	Unit 4 Economics II	0	1
	Unit 5 Safety and Failure Tolerance	0	1

*Project includes three weeks laboratory work during Midyear Recess.

3130
Metallurgy — Part-time Course

Bachelor of Science (Technology) BSc(Tech)

This course is designed for students who are employed in the metallurgical 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.

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

		Hpw S1	S2
Stage 2			
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
5.010	Engineering A†	0	6
5.030	Engineering C†	6	0
		12	12

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

Stage 3			
2.002A	Physical Chemistry	6	0
4.312	Chemical and Extraction Metallurgy IA	1	5
4.802	Metallurgical Physics	0	2
10.031	Mathematics	2	2
	Two General Studies Electives	4	4
		13	13
Stage 4			
4.402	Physical Metallurgy I	6	6
4.512	Mechanical Properties of Solids	4	0
4.602	Metallurgical Engineering I	0	5
25.523	Mineralogy	2	2
		12	13
Stage 5			
1.9222	Electronics	3	0
4.000	Metallurgy Special Topics	0	2
4.433	Physical Metallurgy IIC	9	6
4.522	Mechanical Metallurgy	0	3
		12	11
Stage 6			
4.034	Industrial Metallurgy Project	3	3
4.054	Metallurgy Seminar	2	2
4.514	Industrial Metallurgy	3	3
4.613	Metallurgical Engineering IIA	3	0
4.813	Mathematical Methods	3	3
6.854	Electrical Power Engineering	0	3
		14	14

Ceramic Engineering

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 appli-

cations 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 I	6	6
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
4.231	Introduction to Ceramic Engineering	2	0
5.010	Engineering A	0	6
5.0302	Engineering Drawing and Descriptive Geometry	4	0
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		24	24

Year 2

		Hpw S1	S2
1.9322	Physics (Introduction to Solids)	0	3
2.002A	Physical Chemistry	0	6
2.042C	Inorganic Chemistry	0	6
2.002D	Analytical Chemistry	6	0
4.232	Ceramic Engineering I	3	0
4.941	Metallurgy for Engineers	1	1
7.023	Mineral Process Engineering	2	0
8.112	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 IA*	5	0
48.025	Chemical Engineering for Ceramic Engineers	0	3
48.135	Thermodynamics	3	0
48.163	Instrumentation and Process Control I	0	3
48.311	Fuel Engineering I	2	2
	General Studies Elective	0	4
		24	22

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

Year 4

4.224	Physical Ceramics	6	6
4.234	Ceramic Engineering II	4	4
4.294	Project (Ceramic Engineering)	6	9
18.131	Operations Research*	0	3
48.049	Automation and Optimization for Ceramic Engineers	4	0
	General Studies Elective	2	2
		22	24

*7 weeks only.

3030
Ceramics — Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

Stages 1 and 2*

		Hours per week S1	S2
1.001	Physics I	6	6
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
4.231	Introduction to Ceramic Engineering	0	2
5.010	Engineering A	0	6
5.0302	Engineering Drawing and Descriptive Geometry	4	0
10.001	Mathematics I *or*	6	6
10.011	Higher Mathematics I	6	6

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

Stage 3

2.002A	Physical Chemistry	6	0
2.022D	Analytical Chemistry	6	0
4.941	Metallurgy for Engineers	1	1
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
		11	11

Stage 4

1.9322	Physics (Introduction to Solids)	0	3
2.042C	Inorganic Chemistry	0	6
4.232	Ceramic Engineering I	3	0
7.023	Mineral Process Engineering	2	0
8.112	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 IA*	5	0
48.025	Chemical Engineering for Ceramic Engineers	0	3
48.163	Instrumentation and Process Control I†	0	3
	General Studies Elective	0	2
		11½	11½

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

Stage 6

		Hpw S1	S2
4.213	Chemical Ceramics	6	5
4.823	Numerical Methods	1½	1½
48.135	Thermodynamics	3	0
48.311	Fuel Engineering I	2	2
	General Studies Elective	0	2
		12½	10½

School of Mining Engineering

Head of School
Professor F. F. Roxborough

Administrative Assistant
Mr R. Rolls

Australia is one of the world's largest producers of minerals and, with vast reserves of metallic ores, coal and diverse other minerals, the mining industry of this country is assured of a long and prosperous future. Mining, whether underground, at the surface or on the ocean floor has become a technically advanced activity and education for mining engineers has progressed rapidly to cater for present day and future requirements of the industry. Mining engineers are now frontline executives: they plan, co-ordinate and control the many activities which comprise the operations of a mine. They are in control of all phases of mining projects from the initial planning and development to mineral extraction and processing and final restoration of the land.

To prepare graduates for these tasks, the School of Mining Engineering provides an education in a wide range of engineering topics and associated scientific subjects, at the same time providing a comprehensive insight into the techniques and practices of modern mining, mineral processing and mine management.

The School offers a 4-year full-time course in Mining Engineering leading to the award of the degree of Bachelor of Engineering at Pass or Honours level 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 also comprise Master of Applied Science (MAppSc) degree courses in Minerals Engineering and Mining Geomechanics. The latter 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 are equipped to enter any sector of the mining industry such as coal mining, metalliferous mining, petroleum production, sea-floor mining, quarrying or mineral processing. If they choose to develop careers in production management, they 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 Government of Mines, which in the case of New South Wales coal mining comes under the *Coal Mines Regulation Act No. 37, 1912,* and for metalliferous mining under the *Mines Inspection Act No. 75, 1901.*

Graduate mining engineers are not, however, restricted to primary production for employment. Many find posts in civil sub-surface construction; research and development; with consultants, governments or universities; or with their broad engineering training, in a wide range of manufacturing industries.

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.

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 I	6	6
2.951	Chemistry (ME)	0	6
5.010	Engineering A	6	0
5.0201	Engineering Dynamics	0	3
5.030	Engineering C†	6	0
8.171	Mechanics of Solids I	0	3
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		24	24

†Incorporates 7.111, Introduction to Mining 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
6.855	Electrical Power Utilization	0	4
7.132	Fluid Mechanics and Machines	2	2
7.142	Mine Development†	1	1
8.172	Mechanics of Solids II	4	0
8.250	Properties of Materials	2	2
10.022	Engineering Mathematics II	4	4
10.301	Statistics SA	1½	1½
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
		23	26

†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	4	4
7.133	Mine Transport	0	2½
7.143	Mine Environment and Safety Engineering‡	3½	3½
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
7.313	Minerals Engineering Processes	3	3
25.530	Geology for Mining Engineers II§	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.

		Hpw S1	S2
Year 4			
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
7.314	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 *

School of Textile Technology

Head of School
Professor M. Chaikin

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. Students are normally required to undertake twelve weeks' industrial training during the long recesses between Years 2 and 3, and 3 and 4.

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 I† *or*	6	6
1.011	Higher Physics I		
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
5.010	Engineering A	0	6
6.611	Computing I	6	0
10.001	Mathematics I *or*	6	6
10.011	Higher Mathematics I		
		24	24

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

Textile Chemistry

Year 2

		Hpw S1	S2
2.002A	Physical Chemistry	0	6
2.002B	Organic Chemistry	2	4
2.002D	Analytical Chemistry	6	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
13.111	Textile Technology I	10	6
13.211	Textile Science I	3	3
	General Studies Elective	2	2
		27	25

Year 3

2.003B	Organic Chemistry	6	0
2.003H	Molecular Spectroscopy and Structure	0	6
13.112	Textile Technology II	12	12
13.212	Textile Science II	2	2
13.311	Textile Engineering I	1	1
	General Studies Elective	2	2
		23	23

Textile Physics

Year 2

		S1	S2
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 I	8	8
13.211	Textile Science I	3	3
	General Studies Elective	2	2
		26	23½

Year 3

1.023	Statistical Mechanics and Solid State Physics	4	0
1.042	Measurement and Control Systems	0	5
1.9222	Electronics	3	0
13.112	Textile Technology II	12	12
13.212	Textile Science II	2	2
13.311	Textile Engineering I	1	1
	General Studies Elective	2	2
		24	22

Textile Engineering

Year 2

		Hpw S1	S2
5.0201	Engineering Dynamics IA	3	0
5.0301	Engineering Drawing	0	3
5.300	Engineering Dynamics IB	0	2
7.132	Fluid Mechanics and Machines	2	2
8.112	Structures	3	0
10.022	Engineering Mathematics II	4	4
10.301	Statistics SA	2	2
13.111	Textile Technology I	8	8
13.211	Textile Science I	3	3
	General Studies Elective	2	2
		27	26

Year 3

		S1	S2
1.9222	Electronics	3	0
5.122	Mechanical Engineering Design II	3	3
5.333	Dynamics of Machines	0	3
6.854	Electrical Power Engineering	0	3
13.112	Textile Technology II	12	12
13.212	Textile Science II	2	2
13.311	Textile Engineering I	1	1
	General Studies Elective	2	2
		23	26

Textile Manufacture

Year 2

		S1	S2
10.301	Statistics SA	2	2
13.111	Textile Technology I	8	8
13.211	Textile Science I	3	3
14.501	Accounting and Financial Management IA	4½	0
14.511	Accounting and Financial Management IB	0	4½
15.001	Microeconomics I	3½	0
15.011	Macroeconomics I	0	3½
	General Studies Elective	2	2
		23	23

		Hpw S1	S2
Year 3			
13.112	Textile Technology II	12	12
13.212	Textile Science II	2	2
13.311	Textile Engineering I	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)

13.113	Textile Technology III	6½
13.213	Textile Science III	4
13.312	Textile Engineering II	1½
13.411	Project	7
	Optional*	2
	General Studies Elective	2
		23

*Optional Subjects

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

School of Wool and Pastoral Sciences

Head of School
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 mankind 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 School of Wool and Pastoral Sciences 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 School 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 School.

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 IA	6	0
2.131	Chemistry IB	0	6
9.101	Biology of Grazing Sheep and Cattle*	6	6†
10.001	Mathematics I *or*	6	6
10.011	Higher Mathematics I *or*	6	6
10.021B	General Mathematics IB *and*	6	0
10.021C	General Mathematics IC	0	6
17.031	Biology A	6	0
17.041	Biology B	0	6
27.121	Pedology for Pastoral Sciences	0	5†
		24	24

*Up to 5 days of compulsory field excursions are part of this subject
†This subject extends over 7 weeks of the Session.

Year 2

		Hpw S1	S2
2.003J	Agricultural and Biological Chemistry	4	4
9.111	Livestock Production I*	3	3
9.201	Agronomy	4	4
9.501	Wool Science I	7	7
9.601	Animal Physiology I	6	0
45.101	Biometry	0	6
	General Studies Elective	2	2
		26	26

*A 4 day field excursion is an essential part of the subject.

Year 3

		Hpw S1	S2
9.131	Animal Health I	0	3
9.202	Pastoral Agronomy	3	3
9.301	Agricultural Economics and Management I	3	3
9.421	Animal Nutrition	0	4
9.801	Genetics I	2	3
41.101	Biochemistry	12	0
	General Studies Elective	2	4
		22	23

Plus at least one subject chosen from the list of optional subjects in each session. The choice is to be approved by the Head of School.

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 School who may vary the requirements in special circumstances.

Optional subjects

Group A

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

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

Group B

9.112	Livestock Production II	3	0
9.203	Crop Agronomy†	0	3
9.302	Agricultural Economics and Management II	3	3
9.412	Agricultural Chemistry II	6	6
9.502	Wool Science II	3	3
9.602	Animal Physiology II	4	4
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	Plant Physiology	0	6
43.142	Environmental Botany	6	0
44.101	Introductory Microbiology*	6	0

†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.

Graduate Study

Graduate Enrolment Procedures

All students enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1984* 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 and Wool Technology.

Courses leading to the award of the degree of Master of Applied Science and of Graduate Diplomas are available at Kensington only. 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 in these centres.

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 I
8.861G Investigation of Groundwater Resources II
25.325 Engineering and Environmental Geology
25.411G Arid Zone Engineering Geology*
25.413 Engineering and Environmental Resources

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
27.901G Geomorphology for Hydrologists
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

Prerequistie: 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
27.915G Project in Land Evaluation *or*
27.916G Research Project in Land 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 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‡
25.411G 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†

25.402G Hydrogeology
25.407G Geopollution Management
25.411G Arid Zone Engineering Geology*
25.412G Project in Terrain Management *or*
25.413G 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
27.917G Project in Soil Conservation *or*
27.918G Research Project in Soil Conservation

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‡
25.411G 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.

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 School 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
27.915G Project in Land 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 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‡
25.411G 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.

Terrain Management

Prerequisite: Degree in geology or physical geography, or in a relevant environmental, biological or agricultural science.

Compulsory Subjects†

25.411G Arid Zone Engineering Geology*
25.412G 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 18 hours per week for two sessions of full-time study.

Optional Subjects

8.837G Hydrological Processes
25.402G Hydrogeology
25.407G 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
27.917G Project in Soil Conservation.

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‡
25.411G 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 II
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 III
9.131 Animal Health I
9.132 Animal Health II
9.202 Pastoral Agronomy
9.301 Agricultural Economics and Management I
9.302 Agricultural Economics and Management II
9.421 Animal Nutrition
9.503 Wool Science III
9.504G Wool Science
9.602 Physiology II
9.802 Genetics II
9.803G Animal Breeding
9.811 Biostatistics I
9.812 Biostatistics II
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

*Includes Group Practical Exercises in Remote Sensing, C3.

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
6.458G	Decision and Syntactic Systems for Digital Pattern Recognition	3
6.467G	Digital Image Processing Systems, Scene Analysis and Machine Vision	3
6.468G	Computer Display Systems and Interactive Instrumentation	3
6.611	Computing I	4
6.621	Computing IIA	3
25.816G	Remote Sensing	2
27.642	Mathematical Methods for Spatial Analysis	2
27.643G	Geographic Data Analysis	2
27.672G	Geographic Information Systems	2
27.911G	Soil Erosion and Conservation	6
29.520G	Photogrammetric Production Processes	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):

		Credits
6.458G	Decision and Syntactic Systems for Digital Pattern Recognition	3
6.467G	Digital Image Processing Systems, Scene Analysis and Machine Vision	3
6.468G	Computer Display Systems and Interactive Instrumentation	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 II	3
8.864G	Arid Zone Hydrology	3
8.865G	Arid Zone Water Resources Management	3
25.404G	Environmental Geology	3

25.801G	Geology in Exploration I	4
25.816G	Remote Sensing (in Applied Geology)	2
25.821G	Geology in Exploration II	2
27.171G	Directed Problems in Remote Sensing	3
27.672G	Geographic Information Systems	2
27.914G	Terrain Evaluation	3
29.205G	Satellite Geodesy	3
29.207G	Doppler Positioning	3
29.520G	Photogrammetic Production Processes	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 (20 credits)
- Electives (10 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
46.201G	Themes in Environmental Studies	3
46.203G	Medical Aspects	1
46.204G	Legislative Aspects	1
Project		
46.200G	Project	20

Elective Subjects		Credits
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		
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	Bigeography	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
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 I	2
37.3016	Environmental Impact Assessment II	2
37.5816	Land Systems	3
37.5817	Land Management	2
37.7116	Landscape Planning	3
37.7145	Landscape Planning I	3
37.7146	Landscape Planning II	3
39.908G	Community Noise Control	2
85.716G	Public Policy	3
85.721G	Economics of Natural Resources	2

School 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.

		Hours per week S1	S2
Group A			
25.703G	Project (Engineering Geology Graduate Course)	0	18
Group B			
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 I
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 I
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 II
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 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 I
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 I
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 I
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 I
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 II
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

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:

Bioprocess Engineering	Course **8000**
Chemical Engineering and Industrial Chemistry	Course **8015**
and Fuel Technology	Course **8060**

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

The courses specializing in Chemical Engineering and Industrial Chemistry and Fuel Technology are primarily intended for graduates in Applied Science, Engineering, or Science with principal interests in Chemistry, Mathematics and/or Physics. The course specializing in Bioprocess Engineering is primarily intended for graduates in Agriculture, Applied Science, and Science with principal interests in Biochemistry, Chemistry and/or Microbiology. 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 20 hours weekly for two sessions full-time or ten 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.

Approxomately 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.

8000
Bioprocess Engineering Graduate Courses*

Master of Applied Science
MAppSc

The graduate subjects offered have been utilized to provide maximum flexibility. Any combination of units may be selected, subject to prerequisites or co-requisites as specified. Further, some of these units are designed as bridging material and would not be offered to graduates with previous qualifications in these particular areas.

The units offered are summarized below.

		Hours per week S1		S2
48.281G	Design of Microbial Reactors			
	Unit 1 Rate Processes	1		0
	Unit 2 Fundamentals of Microbial Stoichiometry	1		0
	Unit 3 Design of Microbial Reactors	0		2
48.282G	Microbial Kinetics and Energetics			
	Unit 1 Microbial Kinetics	1		1
	Unit 2 Microbial Energetics	2		2
48.283G	Bioprocess Unit Operations and Equipment Design	3		2
48.284G	Heat, Mass and Momentum Transport	1		1
48.285G	Bioprocess Laboratory	3	*or*	3

This course is designed to provide professional training in the application of chemical engineering principles in the bioprocess industries. It extends over one full-time year or two part-time years and leads to the award of the degree of Master of Applied Science as outlined above.

As the material in this course will be of interest to graduates from a wide range of disciplines, the suggested course outlines consist of a central core selected from the subjects above and a range of background material. This background material can be designed to suit graduates from either of the two groups consisting of firstly Applied Science, Engineering or Science with principal interests in Chemistry, Mathematics, or Physics, or, secondly, Agriculture or Science graduates with principal interests in Biochemistry, Chemistry and/or Microbiology. Graduates with an inadequate background in Mathematics and/or rate processes are required to do a bridging course consisting of a specified reading list with associated assignments up to a maximum of 1 hour per week.

Suggested course outlines for graduates from the two primary areas are given below, however these outlines may be modified to suit individual interests within the general requirements for the MAppSc degree course described above.

Applied Science Graduate or equivalent

Core Subjects

		Hours per week
48.281G	Unit 3 Design of Microbial Reactors	1
48.282G	Microbial Kinetics and Energetics	3
48.283G	Bioprocess Unit Operations and Equipment Design	2½
48.285G	Bioprocess Laboratory	1½
48.900G	Project	6

*For additional information on the MAppSc degree course see above.

Plus 6 hours of other material, for example:

1. Students wishing a more complete coverage of the life sciences may select

		Hpw
42.211G	Principles of Biology	1½
42.212G	Principles of Biochemistry	1½
44.101	Introductory Microbiology*	6 (S1 only)

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

2. Students wishing to reinforce other areas in chemical engineering may select

44.101	Introductory Microbiology*	6 (S1 only)
48.281G	Unit 2 — Fundamentals of Microbial Stoichiometry	½
	plus other elective material	3

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

Science Graduate with a principal interest in the Life Sciences or equivalent

Core Subjects

		Hours per week
48.281G	Unit 1 Rate Prcesses	½
	Unit 3 Design of Microbial Reactors	1
48.282G	Microbial Kinetics and Energetics	3
48.283G	Bioprocess Unit Operations and Equipment Design	2½
48.284G	Heat, Mass and Momentum Transport	1
48.900G	Project	6

Plus 6 hours of other material, for example:

48.063G	Industrial Water and Wastewater Engineering	2
38.159G	Food Process Wastes	½
48.396G	Unit Operations in Waste Management	1½
	Reading List (Mathematics)	1

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.

8005
Chemical Technology Graduate Course*

Master of Applied Science
MAppSc

8010
Chemical Engineering Graduate Course*

Master of Applied Science
MAppSc

8040
Environmental Pollution Control Graduate Course*

Master of Applied Science
MAppSc

These courses have been discontinued. Continuing students should refer to the 1982 Applied Science Handbook for details.

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 (15 or 30% of the program) is 48.900G, 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.

*For additional information on the MAppSc degree course see earlier this section

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.

8080
Industrial Pollution Control Graduate Course*

Master of Applied Science
MAppSc

This course has been discontinued. Continuing students should refer to the 1982 Applied Science Handbook for details.

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.

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 is a necessary introduction to the graduate level of certain subjects. For this purpose the subject, 48.070G Process Principles, is specified.

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 suitable laboratory assignments.

*For additional information on the MAppSc degree course see earlier this section.

Year 1

		Hours per week
48.070G	Process Principles *or*	2
48.072G	Corrosion Laboratory	2
48.071G	Corrosion Technology I	3
		5

Chemical Engineering graduates will undertake:

48.072G Corrosion Laboratory

Science Graduates who have passed the equivalent of second year Chemistry will undertake parts of:

48.070G Process Principles (1 hr/wk)
48.072G Corrosion Laboratory (1 hr/wk)

Graduates who have passed only the equivalent of first year Chemistry will undertake 48.070G Process Principles.

Year 2

48.073G	Corrosion Materials	2
48.074G	Corrosion Technology II	3
48.075G	Seminar	1
48.076G	Corrosion Literature Review	2
48.077G	Testing Laboratory (by roster)	2
		10

School of Food Technology

The School of Food Technology conducts formal courses leading to the award of the Master of Applied Science degrees and of the Graduate Diploma in food technology.

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

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 20 hours weekly for two sessions full-time or ten 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 30 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 Food Technology. The remainder, subject to approval and availability, may be undertaken in other schools within the University.

Graduate subjects in Food Technology may be selected from:

		Hours per week*
38.151G	Introductory Food Science	1
38.152G	Food Process Laboratory	2
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
38.163G	Methods in Food and Nutrition Education	1½
38.164G	Elements of Food Preservation	2½
38.165G	Plant Food Products	2
38.166G	Animal Food Products	1½
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

		Hpw

*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 and students are admitted to the program in the second session of each year. The details of the course are as follows:

Session A		Hours per week*
38.601G	Food Technology A	3
38.602G	Technology of Food Preservation A	3
38.603G	Food Engineering A	3
38.604G	Food Engineering B	3
38.902G	Reading Assignment or Elective Material	3
		15

		Hpw
Session B		
38.605G	Food Technology B	3
38.606G	Technology of Food Preservation B	3
38.607G	Technology of Food Processing A	3
38.608G	Food Engineering C	3
38.901G	Minor Project	3
	Elective Material	3
		18
Session C		
38.609G	Technology of Food Processing B	3
38.610G	Food Engineering D	3
38.611G	Food Engineering Laboratory	3
38.612G	Food Engineering Field Work	3
38.901G	Minor Project	3
		15

*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 of Food Technology. 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.

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	2
38.164G	Elements of Food Preservation	2½
38.165G	Plant Food Products	2
38.166G	Animal Food Products	1½
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
38.163G	Methods in Food and Nutrition Education	1½
38.341	Food Microbiology II	3
38.344	Yeast Technology	1½
38.431	Food Engineering II	3
38.442	Food Engineering III	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
44.143	Microbiology AS	5

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 Metallurgy

The School of Metallurgy conducts courses which lead to the award of Master of Applied Science.

In addition, the School welcomes enquiries from graduates in Science, Engineering and Applied Science who are interested in doing research leading to the award of the degrees of Master of Science, Master of Engineering or Doctor of Philosophy in metallurgy or ceramic engineering.

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.

8050
Metallurgy Graduate Course

Master of Applied Science
MAppSc

This course provides for a comprehensive study of the theoretical and practical topics at an advanced level. It is designed to allow the maximum flexibility in choice of topics consistent with the standing of the award.

Intending candidates are invited to discuss proposed study programs with the Head of the School for advice and recommendation.

An acceptable program would be:

1. A program of formal study (including a project) totalling approximately twenty hours per week for two sessions full-time.

2. A project comprising about twenty per cent of the program.

At least eighty per cent of the total program must be composed of units selected from those available as part of the graduate subjects listed below, except that not more than eight hours per week for two sessions may be devoted to each of 4.211G Metallurgical Practice and 4.231G Advanced Theoretical Metallurgy and not more than six hours per week for two sessions may be devoted to 4.221G Advanced Metallurgical Techniques.

Graduate Subjects

		Hours per week*
4.241G	Graduate Metallurgy Project	Not less than 4
4.211G	Metallurgical Practice Detailed studies relating to one or more of the following: **1.** Extractive Metallurgy **2.** Metal working and forming **3.** Foundry practice **4.** Welding and metal fabrication **5.** Metal finishing and corrosion protection	4 to 8
4.221G	Advanced Metallurgical Techniques	1 to 2
4.231G	Specialist lectures in Advanced Theoretical Metallurgy	Offered in units of 7 hours (ie 1 hour/ week for 7 weeks)
4.251G	Advanced Materials Technology	3
4.270G	Solid State and Mineral Chemistry	2
4.271G	Refractory Technology I	6
4.272G	Refractory Technology II	6
4.281G	Chemistry of Glass Melting	6

*These may be presented at twice the weekly rate over one session.

Undergraduate Study

These subjects are intended for inclusion in qualifying courses and to satisfy prerequisites and co-requisites for students whose first degree is in a field other than metallurgy.

		Hours per week
4.121	Principles of Metal Extraction	3
4.131	Principles of Physical and Mechanical Metallurgy	3
4.141	Experimental Techniques in Physical Metallurgy	2

The above undergraduate subjects offered by the School of Metallurgy and undergraduate and graduate subjects offered by other Schools of the University may be included, but may not exceed 20 per cent of the total program.

School of Mining Engineering

8055
Minerals Engineering Graduate Course

Master of Applied Science
MAppSc

The course is designed to provide a comprehensive study of theoretical and practical aspects of mineral processing technology at an advanced level. Formal subjects represent approximately 75 per cent of the program, the remaining 25 per cent being devoted to a project. Election in choice of project work permits specialization in mineral processing or coal preparation. Candidates who do not have an appropriate academic background may be required to enrol in related undergraduate subjects as prerequisites. Consideration is given to full-time or part-time enrolment.

Subjects

		Hours per week S1	S2
7.013	Principles of Mining	2	0
7.361G	Minerals Engineering I	7	0
7.362G	Minerals Engineering II	8	0
7.363G	Minerals Engineering Laboratory	3	0
7.364G	Minerals Engineering III	0	8
7.365G	Minerals Engineering Project	0	10
7.442G	Minerals Industry Analysis	0	2
		20	20

1. When appropriate, and subject to the approval of the Head of the Department, up to 4 hours per week may be selected from approved courses offered within the University in place of units in which students have prior expertise.

2. Undergraduate material may not exceed 20 per cent of the total program.

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

4. Attendance at field trips totalling up to one week may be required.

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 School of Mining Engineering, 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 School.

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	S3
7.515X	Rock Mechanics Measurements	3	3	
7.525X	Strata Control Engineering			3
8.776G	Rock Mechanics			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			3
8.778G	Geotechnical Processes for Energy Resources			3
8.780G	Geological Engineering			3
25.702G	Hydrogeology*			3
25.706G	Geological Basis of Geomechanics			3
25.708G	Engineering Geology			3

*Subject not available in 1984. 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 the School of Mining Engineering.

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
7.023	Mineral Process Engineering	2	0
7.033	Mineralogical Assessment	1	0
7.234	Mineral Economics	1	1
7.311G	Mineral Beneficiation	0	3
7.111G	Mining Engineering	0	3
		6	7

Year 2 — Part-time

7.122G	Mining Engineering Technology	3	3
	or		
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 School or offered by other Schools within the University.

School of Wool and Pastoral Sciences

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, 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.

Applicants from Colleges of Advanced Education who have obtained credit passes or better in the Diploma of Applied Science (Agriculture) are eligible for consideration for direct entry into the Graduate Diploma course in Wool and Pastoral Sciences.

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.

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 Table (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 Architecture	MArch	Architecture
Master of Archives Administration	MArchivAdmin	Professional Studies

Higher Degrees (continued)

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 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 Public Administration	MPA	AGSM
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

Title	Abbreviation	Calendar/Handbook
Master of Science and Society	MScSoc	Sciences*
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 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

Graduate Diplomas

Graduate Diploma	GradDip	Applied Science Architecture Engineering Sciences*§
	DipFDA	Sciences*
	DipEd	Professional Studies
	DipIM-ArchivAdmin	
	DipIM-Lib	

*Faculty of Science.
§Faculty of Biological Sciences.

Doctor of Philosophy (PhD)

1. The degree of Doctor of Philosophy may be granted by the Council on the recommendation of the Professorial Board to a candidate who has made an original and significant contribution to knowledge and who has satisfied the following requirements:

Qualifications

2. A candidate for registration for the degree of Doctor of Philosophy shall:

(1) hold an honours degree from the University of New South Wales; or

(2) hold an honours degree of equivalent standing from another approved university; or

(3) if the candidate holds a degree without honours from the University of New South Wales or other approved university, have achieved by subsequent work and study a standard recognised by the Higher Degree Committee of the appropriate faculty or board of studies (hereinafter referred to as the Committee) as equivalent to honours; or

(4) in exceptional cases, submit such other evidence of general and professional qualifications as may be approved by the Professorial Board on the recommendation of the Committee.

3. When the Committee is not satisfied with the qualifications submitted by a candidate, the Committee may require the candidate, before being permitted to register, to undergo such examination or carry out such work as the Committee may prescribe.

Registration

4. A candidate for registration for a course of study leading to the degree of Doctor of Philosophy shall apply to the Registrar on the prescribed form at least one calendar month before the commencement of the session in which registration is to begin.

5. Subsequent to registration the candidate shall pursue a program of advanced study and research for at least six academic sessions, save that:

(1) a candidate fully engaged in advanced study and research for the degree, who before registration was engaged upon research to the satisfaction of the Committee, may be exempted from not more than two academic sessions;

(2) in special circumstances the Committee may grant permission for the candidate to spend not more than one calendar year of the program in advanced study and research at another institution provided that the work can be supervised in a manner satisfactory to the Committee;

(3) in exceptional cases, the Professorial Board on the recommendation of the Committee may grant permission for a candidate to be exempted from not more than two academic sessions.

6. A candidate who is fully engaged in research for the degree shall present for examination not later than ten academic sessions from the date of registration. A candidate not fully engaged in research shall present for examination not later than twelve academic sessions from the date of registration. In special cases an extension of these times may be granted by the Committee.

7. The candidate shall be fully engaged in advanced study and research, save that:

(1) the Committee may permit a candidate to undertake a limited amount of University teaching or outside work which in its judgment will not interfere with the continuous pursuit of the proposed course of advanced study and research;

(2) a member of the full-time staff of the University may be accepted as a part-time candidate for the degree, in which case the Committee shall prescribe a minimum period for the duration of the program;

(3) in special circumstances, the Committee may, with the concurrence of the Professorial Board, accept as a part-time candidate for the degree a person who is not a member of the full-time staff of the University and is engaged in an occupation which, in its opinion, leaves the candidate substantially free to pursue a program in a school* of the University. In such a case the Committee shall prescribe for the duration of the program a minimum period which, in its opinion, having regard to the proportion of the time which the candidate is able to devote to the program in the appropriate University school* is equivalent to the six sessions ordinarily required;

(4) the Committee may permit a candidate to transfer to part-time enrolment where that candidate has completed the research work, is writing the thesis, and has been registered as a full-time candidate for at least six academic sessions.

8. Every candidate shall pursue a program under the direction of a supervisor appointed by the Committee from the full-time members of the University staff. The work other than field work shall be carried out in a school* of the University save that in special cases the Committee may permit a candidate to conduct the work at other places where special facilities not possessed by the University may be available. Such permission will be granted only if the direction of the work remains wholly under the control of the supervisor.

9. Not later than two academic sessions after registration the candidate shall submit the topic of research for approval by the Committee. After the topic has been approved it may not be changed except with the permission of the Committee.

10. A candidate may be required by the Committee to attend a formal course of appropriate study.

Thesis

11. On completing the course of study every candidate must submit a thesis which complies with the following requirements:

(1) the greater proportion of the work described must have been completed subsequent to registration for the PhD degree;

(2) it must be an original and significant contribution to the knowledge of the subject;

(3) it must be written in English except that a candidate in the Faculty of Arts may be required by the Faculty on the recommendation of the supervisor to write the thesis in an appropriate foreign language;

(4) it must reach a satisfactory standard of expression and presentation.

*Or department where a department is not within a school.

12. The thesis must present the candidate's own account of the research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied on the candidate's part in the joint research.

13. Every candidate shall be required to submit with the thesis a short abstract of the thesis comprising not more than 350 words.

The abstract shall indicate:

(1) the problem investigated;

(2) the procedures followed;

(3) the general results obtained;

(4) the major conclusions reached;

but shall not contain any illustrative matter, such as tables, graphs or charts.

14. A 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.

15. The candidate shall give in writing two months' notice of intention to submit the thesis.

Entry for Examinations

16. 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 higher degree theses. The candidate may also submit any work previously published whether or not such work is related to the thesis.

17. 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.

18. There shall normally be 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.

19. 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:

(1) the candidate be awarded the degree without further examination; or

(2) 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

(3) 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

(4) 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

(5) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

20. If the performance at the further examination recommended under Rule **19.** (3) 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 them but not exceeding eighteen months.

21. 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 admitted to the degree.

22. A candidate shall be required to pay such fees as may be determined from time to time by the Council.

Fees

Master of Applied Science (MAppSc)

1. The degree of Master of Applied Science may be awarded by the Council on the recommendation of the Higher Degree Committee of the Faculty of Applied Science (hereinafter referred to as the Committee) to a candidate who has satisfactorily completed an approved program of advanced study.

Qualifications

2. (1) An applicant for registration for the degree shall normally be a graduate from an appropriate four-year, full-time undergraduate course in the University or other approved university or tertiary institute at a standard acceptable to the Committee.

(2) The Committee may consider applications from graduates of three-year, full-time courses in the University or other approved university or tertiary institute who have satisfactorily completed an approved qualifying program of not less than one year full-time or its equivalent or have submitted evidence of attainment in appropriate graduate studies extending over a period of not less than one full-time year or its equivalent.

(3) The Committee may also consider applications from graduates of the Bachelor of Science (Technology) and Bachelor of Science (Engineering) courses of the University who have satisfactorily completed an approved qualifying program of not less than one year part-time or who can submit evidence of academic attainment in appropriate graduate studies extending over the same period or its equivalent.

(4) Notwithstanding any other provisions of these conditions the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and taking such examinations as the Committee may determine.

Registration and Progression

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least two months before the commencment of the course.

(2) A candidate for the degree shall be required to undertake such course of formal study, pass such examinations and, where specified, submit a report on a project, as prescribed by the Committee.

(3) No candidate shall be considered for the award of the degree until the lapse of two sessions in the case of a full-time candidate or four sessions in the case of a part-time candidate from the date from which registration becomes effective. The Committee may approve remission of up to two sessions for a part-time candidate.

(4) The progress of a candidate shall be reviewed annually be the Committee on the recommendation of the Head of School or Department in which the candidate is registered and as a result of such review the Committee may terminate the candidature.

Project

4. (1) Where specified, a report on a project approved by the Committee may be submitted at the completion of the formal section of the course, but in any case shall be submitted not later than one year after the completion of such course.

(2) The format of the report shall accord with the instructions of the Head of School and shall comply with the requirements of the Committee for the submission of project reports.

(3) The report shall be under the supervision of a member of the academic staff and shall be examined by two examiners. The satisfactory completion of the project shall be regarded as part of the annual assessment.

Recommendation for Admission to Degree

5. Having considered the candidate's results in the prescribed course of study, the Committee shall recommend whether the candidate may be admitted to the degree.

Fees

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering (ME)

1. The degree of Master of Engineering 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 investigation.

Qualifications

2. (1) An applicant for registration for the degree shall have beem admitted to the degree of Bachelor in the University of New South Wales, or other approved university or tertiary institution, in an appropriate school or department at a standard acceptable to the Committee.

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if the person submits evidence of such academic and professional attainments, as may be approved by the appropriate Committee.

(3) Notwithstanding any other provisions of these conditions, the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

Registration

3. (1) An application to register as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

(2) In every case, before permitting an applicant to register as a candidate, the Committee shall be satisfied that adequate supervision and facilities are available.

(3) An approved applicant shall register in one of the following categories:

(a) student in full-time attendance at the University

(b) student in part-time attendance at the University

(c) student working externally to the University

(4) Every candidate for the degree shall be required to carry out a program of advanced study to take such examinations and perform such other work as may be prescribed by the Committee which shall include the preparation and submission of a thesis embodying the results of an original investigation. The work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine. At least once a year and at any other time that the Committee sees fit, the candidate's supervisor shall present to the head of the school in which the candidate is registered, a report on the progress of the candidate. The Committee shall review the report and may, if it decides as a result of its review that the progress of the candidate is unsatisfactory, cancel registration or take such other action as it considers appropriate.

(5) No candidate shall be considered for the award of the degree until the lapse of four complete sessions from the date from which registration becomes effective save that, in the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may, with the approval of the Committee, be reduced by up to two sessions.

Thesis

4. (1) A candidate for the degree shall be required to submit three copies of the thesis referred to in paragraph **3.** (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit any work the candidate has published whether or not such work is related to the thesis.

(2) For each candidate there shall be at least two examiners appointed by the Professorial Board, on the recommendation of the Committee one of whom shall, if possible, be an external examiner.

(3) 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.

Recommendation for Admission to Degree

5. Having considered the examiners' reports the Committee shall recommend whether or not the candidate should be admitted to the degree.

Fees

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Master of Environmental Studies (MEnvStudies)

1. The degree of Master of Environmental Studies may be awarded on the recommendation of the Higher Degree Committee of the Faculty of Applied Science (hereinafter referred to as the Committee) to a candidate who has satisfactorily completed a progrm of advanced study comprising formal course work and the submission of a report on a project approved by the Committee.

Qualifications

2. (1) An applicant for registration for the degree shall normally be a graduate from an appropriate four-year full-time undergraduate course in the University or other approved university or tertiary institution at a standard acceptable to the Committee.

(2) An applicant may also be permitted to register as a candidate for the degree by submitting evidence of such academic or professional attainments as may be approved by the Committee.

(3) Notwithstanding any other provisions of these conditions the committee may require an applicant to demonstrate fitness for registration by carrying out such work and taking such examinations as the Committee may determine.

Registration

3. (1) An application to register as a candidate for the degree of Master shall be made on the prescribed form which shall be lodged with the Registrar at least two (2) months before the commencement of the course.

(2) A candidate for the degree shall be required to undertake such course of formal study, pass such examinations and submit a report on a project as prescribed by the Committee.

(3) No candidate shall be considered for the award of the degree until the lapse of two sessions in the case of a full-time candidate or four sessions in the case of a part-time candidate from the date from which registration becomes effective.

(4) The progress of a candidate shall be reviewed annually by the Committee and as a result of such review the Committee may terminate the candidature.

Project

4. (1) A report on a project approved by the Committee shall be submitted at the completion of the formal section of the course, but in any case not later than one year after the completion of such course.

(2) The format of the report shall accord with the requirements of the Committee for the submission of project reports.

(3) (a) The report shall be examined by two examiners appointed by the Committee;

(b) A candidate may be required to attend for an oral or written examination.

Recommendation for Admission to Degree

5. Having considered the examiners' report and the candidate's other results in the prescribed course of study, the Committee shall recommend whether or not the candidate should be admitted to the degree.

Fees

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Master of Science (MSc)

1. The degree of Master of Science may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate Faculty or Board of Studies (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) An applicant for registration for the degree shall have been admitted to the degree of Bachelor in the University of New South Wales, or other approved university or tertiary institution in an appropriate school or department at a standard acceptable to the committee.

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if the person submits evidence of such academic and professional attainments as may be approved by the appropriate Committee.

(3) Notwithstanding any other provisions of these conditions the Committee may require an applicant to demonstrate fitness for registration by carrying out such work and sitting for such examinations as the Committee may determine.

Registration

3. (1) An application to register as a candidate for the degree of Master of Science shall be made on the prescribed form which shall be lodged with the Registrar at least one full calendar month before the commencement of the session in which the candidate desires to register.

(2) In every case before permitting an applicant to register as a candidate the Committee shall be satisfied that adequate supervision and facilities are available.

(3) An approved applicant shall register in one of the following categories:

(a) student in full-time attendance at the University;

(b) student in part-time attendance at the University;

(c) student working externally to the University.

(4) Every candidate for the degree shall be required to submit three copies of a thesis embodying the results of an original investigation or design, to take such examinations and to perform such other work as may be prescribed by the Committee. This work shall be carried out under the direction of a supervisor appointed by the Committee or under such conditions as the Committee may determine.

(5) At least once a year and at any other time that the Committee sees fit, the candidate's supervisor shall present to the head of school or department in which the candidate is registered a report on the progress of the candidate. The Committee shall review the report and may, if it decides as a result of its review that the progress of a candidate is unsatisfactory, cancel registration or take such other action as it considers appropriate.

(6) Unless otherwise recommended by the Committee, no candidate shall be awarded the degree until the lapse of four complete sessions from the date of registration, save that the case of a candidate who obtained the degree of Bachelor with Honours or who has had previous research experience, this period may be reduced by up to two sessions with the approval of the Committee. A candidate who is fully engaged in research for the degree shall present for examination not later than six academic sessions from the date of registration. A candidate not fully engaged in research shall present for examination not later than twelve academic sessions from the date of registration. In special cases an extension of these times may be granted by the Committee.

Thesis

4. (1) A candidate for the degree be required to submit three copies of the thesis referred to in paragraph **3.** (4) which shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses. The candidate may submit also for examination any work he has published whether or not such work is related to the thesis.

(2) For each candidate there shall be at least two examiners, appointed by the Professorial Board on the recommendation of the Committee, one of whom, if possible, shall be external to the University.

(3) 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.

Recommendation for Admission to Degree

5. Having considered the examiners' reports the Committee shall recommend whether or not the candidate should be admitted to the degree.

Fees

6. An approved candidate shall pay such fees as may be determined from time to time by the Council.

Master of Science (MSc) and Master of Engineering (ME) *without supervision*

1. Where it is not possible for candidates to register under the normal conditions for the degree of Master of Science, Master of Engineering or Master of Surveying by reason of their location at centres which are distant from University Schools or where effective supervision is not practicable registration may be granted in these categories under the following conditions:

Qualifications

2. An applicant for registration shall have been admitted to a degree of Bachelor in the University of New South Wales at a standard acceptable to the Higher Degree Committee of the appropriate Faculty (hereinafter referred to as the Committee).

	School, Department etc	Faculty	Page
	*Subjects also offered for courses in this handbook		
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59	Department of Russian	Arts	
60	Faculty of Arts	Arts	
61	Department of Music	Arts	
62	School of History and Philosophy of Science	Arts	
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73	School of Physiology and Pharmacology	Medicine	
74	School of Surgery	Medicine	
75	School of Obstetrics and Gynaecology	Medicine	
76	School of Paediatrics	Medicine	
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Physics

Undergraduate Study

Physics Level I Units

1.001 Physics I — 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.

1.011 Higher Physics I — F L3T3

Prerequisites: As for 1.001; plus permission of the Head of the School of Physics. Co-requisite: 10.001 or 10.011.

For students of all Faculties except Medicine who have a good secondary school record and who wish to do a more challenging course.

Vector algerbra, kinematics, uniform circular motion, coriolis acceleration, dynamics of particles, motion in a resistive medium, work and energy, gravitation, rotational motion of rigid bodies about fixed axis, rotational motion about a fixed point. Harmonic motions, waves in elastic media. Sound waves, physical optics, polarization and double refraction. Electric charges, electric intensity, electric flux, Gauss' law, electric potential, capacity, dielectric materials, electric current and resistance, DC circuits, magnetic field, field due to current, electromagnetic induction, inductance, magnetic materials, transients, AC circuits, electronics, diode, rectifier circuit, simple power supplies, electronic amplifier systems, single loop feedback systems, signal processing circuits using operational amplifiers.

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

Prerequisites: None. Co-requisites: 10.021A & 10.021B, or 10.021B & 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, electronics, 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.

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 — F L1½T½

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.

1.032 Laboratory — F T3

Prerequisites: 1.001 or 1.011, 10.001. Excluded: 1.9222.

Alternating current circuits, complex impedance, resonance, mutual inductance, introductory electronics, diode and characteristics and circuits, power supplies, transistor characteristics, single stage and coupled amplifiers, experiments using AC circuits. Experimental investigations in a choice of areas including radioactivity, spectroscopy, properties of materials, Hall effect, nuclear magnetic resonance, photography, vacuum systems.

Terminating Physics Level II Units

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

1.0133 Quantum Mechanics — S1 L1½T½

Prerequisites: 1.022; 10.2112. Excluded: 2.023A, 10.222F, 1.013.

Revision of basic concepts, harmonic oscillator systems, spherically symmetric systems, angular momentum, H atom, first-order perturbation theory, identical particles, Exclusion Principle, atomic structure, spin-orbit coupling, Helium atom, introductory quantum theory of molecules.

1.0143 Nuclear Physics — S2 L1½T½

Co-requisite: 1.0133. Excluded: 1.013.

Nuclear shell model; theory of beta decay; the deuteron, nucleon-nucleon scattering; theories of nuclear reactions, resonances; mesons and strange particles, elementary particle properties and interactions; symmetries and quark models; strong and weak interactions.

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.

1.0333 Electromagnetism — S1 L1½T½

Prerequisites: 1.012, 10.2111, 10.2112. Excluded: 10.222C, 1.033.

Electromagnetic fields; Maxwell's equations, Poynting theorem, electromagnetic potentials, electromagnetic waves. Reflection and transmission, Fresnel equations, waveguides, radiation fields, dipoles and antenna theory.

1.0343 Advanced Optics — S2 L1½T½

Co-requisite: 1.002. Excluded: 1.033.

Fresnel and Fraunhofer diffraction, Fourier transforms, filtering, coherence length and time, stellar interferometers, laser theory, nonlinear optics.

1.043 Experimental Physics A — F T4

Prerquisite: 1.032.

Basic experimental techniques and analysis of results in the following areas: electricity, magnetism, diffraction optics (including X-ray and electron diffraction, solid state physics, nuclear physics, atomic physics and spectroscopy, vacuum systems).

Chemistry

Undergraduate Study

2.002A Physical Chemistry — S1 or S2 L3T3

Prerequisites: 2.121 or 2.141 and 10.011 or 10.001 or 10.021B & 10.021C.

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.

2.002B Organic Chemistry — F or S1 or S2 L3T3

Prerequisite: 2.131 or 2.141.

Chemistry of the more important functional groups; aliphatic hydrocarbons, monocyclic aromatic hydrocarbons, halides, alcohols, phenols, aldehydes, ketones, ethers, carboxylic acids and their derivatives, nitro compounds, amines and sulphonic acids.

2.002D Analytical Chemistry — SS L2T4

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

Chemical equilibria in analytical chemistry. Acid-base, complex formation, redox systems, solid/solution, and liquid/liquid equilibria with applications to volumetric, gravimetric and complexometric analysis, and to liquid/liquid extractions. Spectrophotometry, basic principles. Chromophores. Fundamentals of precision. Electrochemistry, theory and applications to electrodeposition and potentiometry; ion selective electrodes. radioactive tracer techniques. Data evaluation in analytical chemistry. Qualitative analysis.

2.003B Organic Chemistry — S1 or S2 L2T4

Prerequisite: 2.002B.

Alicyclic Chemistry. Stereochemistry of acyclic systems; classical and non-classical 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 medium rings. Synthesis and reactions of fused and bridged polycyclic systems. *Heterocylic Chemistry.* Synthesis and reactions of the following heteroaromatic systems; pyridine, quinoline, isoquinoline. Flavones and isoflavones; pyrimidine; pyrrole, furan, thiophen. Indole, imidazole.

2.003H Molecular Spectroscopy and Structure — S2 L3T3

Prerequisite: 2.121 & 2.131, or 2.141.

Absorption and emission of radiation. Atomic spectra. Molecular spectroscopy: vibrational, including infrared and Raman; UV-visible; instrumentation and sample handling. Magnetic resonance. Mass spectometry with particular reference to structure determination. Laboratory and tutorial work to illustrate the above, including inspection of major instruments.

2.003J Fundamentals of Biological and Agricultural Chemistry — SS L2T4

Prerequisites: 2.121 & 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.

2.013L Chemistry and Enzymology of Foods — F L1T2

Prerequisite: 2.002B. Excluded: 2.003J, 2.043L, 2.023L, 2.053L.

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.

2.030 Organic Chemistry — S1 L1P4 S2L1

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.

2.042C Inorganic Chemistry — SS L2T4

Prerequisites: 2.121 or 2.131 or 2.141.

Chemistry of the non-metals including B, C, Si, N, P and S. Chemistry of the metals of groups IA, IIA, and Al. Typical ionic, giant-molecule and close-packed structures. Transition metal chemistry, including variable oxidation states, paramagnetism, Werner's theory, isomerism of six and four-coordinate complexes, chelation, stabilization of valency states. Physical methods of molecular structure determination. Chemistry of Fe, Co, Ni, Cu, Ag, Au and Hg.

2.043A Environmental Chemistry — S2 L3T3

Prerequisites: 2.002A, 2.002D.

Physico-chemical aspects of atmosphere chemistry: dispersion of colloids and solid matter, photochemical reactions. Hydrological cycle: reactions in the sea, rivers and estuaries; chemical characteristics of surface and sub-surface waters. Corrosion of metals.

and either
Simple digital and analogue computer models of ecological systems based on chemical data and physico-chemical properties.

or
Distribution of elements and nutrient cycles in water; organic carbon cycles, oxygen balance (redox processes in aquatic systems). Chemical models of these processes (including an introduction to simple computing). Practical project (mostly field work) dealing with nutrient cycles.

2.043L Chemistry and Enzymology of Foods — F L2T4

Prerequisite: 2.002B. Excluded: 2.013L, 2.023L, 2.053L.

Reference: 2.043L and 2.053L: only one of these double units may be chosen.

As for 2.013L but in greater detail and depth.

2.111 Introductory Chemistry — S1 L2T4

Prerequisite: None.

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, neutralisation. 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 IA — 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 (multistrand) or	*31-100*
2 unit Science (Geology) or	*51-100*
2 unit Science (Biology)	*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).

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.

2.131 Chemistry IB — S1 or S2 L2T4

Prerequisite: 2.111 or 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.

2.141 Chemistry IM — F L2T4

Prerequisites: As for 2.121 Chemistry 1A.

Note: As for note, 2.121 Chemistry IA.

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 IME — S2 L2T3

Prerequisite: Nil.

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.

Graduate Study

2.251G Toxicology, Occupational and Public Health — F L1T2

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.

Metallurgy

Undergraduate Study

4.001 Introduction to Materials Science — S1 or S2 L1

Forms part of 5.010 Engineering A.

The structure and properties of the main types of engineering materials, with emphasis on the way in which properties may be controlled by controlling structure.

4.002 Introduction to Metallurgical Engineering — S2 L2

Forms part of 5.030 Engineering C.

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.

4.024 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 **F3**

An experimental investigation of some aspects of industrial metallurgy.

4.054 Metallurgy Seminar **F L2**

Lectures on the preparation and presentation of technical papers. Each student is required to prepare and present a paper on a nominated subject.

4.121 Principles of Metal Extraction **F L2T1**

The fundamental principles of metal extraction. Oxidation and reduction, roasting, slag reactions, distillation, leaching, precipitation and electrolysis.

4.131 Principles of Physical and Mechanical Metallurgy **F L3T0**

A condensed treatment of physical and mechanical metallurgy.

4.141 Experimental Techniques in Physical Metallurgy **F L0T2**

A condensed course of instruction in metallographic, crystallographic and X-ray diffraction techniques.

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 I **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 II **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.

4.302 Chemical and Extraction Metallurgy I **F L1T2**

Co-requisite: 2.002A.

Metal extraction from ores in terms of unit operations and overall systems, illustrated by the extraction of iron, copper, aluminium and other metals. Elementary process analysis. Laboratory — analysis and solution of problems.

4.303 Chemical and Extraction Metallurgy II **F L3T2**

Prerequisites: 4.302, 4.602 and 4.402 or 4.412. Co-requisite: 4.222.

Metallurgical thermodynamics, application to equilibria involving liquid metals, slags, gases and the solid state. Electrochemistry; corrosion; hydrometallurgy. Kinetics applied to metallurgical processes. Process assessment and selection.

4.312 Chemical and Extraction Metallurgy IA **S1 L1TO S2 L2T3**

Co-requisites: 2.002A

As for subject 4.302 above.

4.314 Chemical and Extraction Metallurgy IIIA **S1 L3 T1½**

Prerequisite: 4.303.

Kinetics of interphase transfer in metallurgical systems. Advances in pyrometallurgy related to fuel utilization, agglomeration, emission, recycling. Advances in hydrometallurgy. Corrosion and oxidation, selection of materials.

4.324 Chemical and Extraction Metallurgy IIIB — S2 L3½T1

Prerequisite: 4.303.

A selection of advanced topics in chemical and extractive metallurgy.

4.374 Metal Extraction Processes — F L2T1

Analysis of pyrometallurgical and hydrometallurgical extraction and refining processes using the principles of chemical equilibrium and kinetics. Extraction and refining processes for commercially important ferrous and non-ferrous metals. Nature of the inter-relationship between raw material, extraction process and product characteristics. Economic factors in process selection and operation; acceptance standards for ores and concentrates, smelter charges; penalties and bonuses; by-products.

4.402 Physical Metallurgy I — S1 L3T3 S2 L2T4

Co-requisites: 2.002A, 4.502. Excluded: 1.9322, 4.412, 4.422.

The crystal structure of metallic phases. Crystal defects. Physical properties of solids. X-ray diffraction. Phase equilibrium in alloy systems. The genesis of microstructure. Mechanisms of phase transformations, departures from equilibrium, metastable transition phases. Heat treatment of alloys. Structure of carbon steels and cast irons. Optical metallography.

4.403 Physical Metallurgy II — F L4T5

Prerequisite: 4.402. Excluded: 1.3033.

Diffusion in metals. Nucleation of phase transformations. Mechanisms of precipitation in the solid state. Metallography and properties of commercial alloys. Geometry of deformation in metals. Introduction to dislocation theory and its application to mechanical behaviour of alloys. Zone theory of solids — application to electrical, thermal and magnetic properties and to theory of alloys. Preferred orientation in metals. Optical, X-ray and electron metallography.

4.404 Physical Metallurgy III — S1 L3T4½ S2 L3T1½

Applications of dislocation theory to work hardening and annealing processes. Phase transformations in alloys. Mathematical crystallography, reciprocal lattice, diffraction. Electron and X-ray metallography. Selection of advanced topics in physical metallurgy including radiation damage, martensitic transformations, neutron diffraction, internal friction, sintering, creep, superelasticity, fracture, microplasticity.

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. Metallogragphy.

4.414 Physical Metallurgy IIIA — S1 L3T1½

Prequisite: 4.403.

Applications of dislocation theory to work hardening and annealing processes. Phase transformations in alloys. Mathematical crystallography, reciprocal lattice, diffraction. Electron and X-ray metallography.

4.422 Metallurgical Phases — Structure and Equilibrium, Part 2 — S2 L2T4

Prerequisite: 4.412. Co-requisite: 4.303. Excluded: 4.402.

X-rays and X-ray diffraction. Mechanism of phase transformations, departures from equilibrium, metastable transition phases. Principles of heat treatment. Optical and X-ray examination of metallurgical materials.

4.424 Physical Metallurgy IIB — S1 L0T3 S2 L3T1½

Prerequisite: 4.403.

Selection of advanced topics in phyical metallurgy including radiation damage, martensitic transformations, neutron diffraction, interal friction, sintering, creep, superelasticity, fracture, microplasticity.

4.433 Physical Metallurgy IIC — S1 L4T5 S2 L3T3

Prerequisite: 4.402.

Diffusion in metals. Nucleation of phase transformations. Mechanisms of precipitation in the solid state. Metallography and properties of commercial alloys. Geometry of deformation in metals. Introduction to dislocation theory and its application to mechanical behaviour of alloys. Optical, X-ray and electron metallography. Preferred orientation to metals.

4.502 Mechanical Metallurgy — S1 L2T2 S2 L1T2

Co-requisite: 4.402.

Combination of 4.512 and 4.522.

4.512 Mechanical Properties of Solids — S1 L2T2

Co-requisite: 4.402.

The nature and significance of mechanical properties. Analysis of stress and strain. Stress/strain/time relationships. Influence of stress state, temperature, strain rate and environment on mechanical behaviour. Modes of failure under load. Mechanical testing.

4.522 Mechanical Metallurgy — S2 L1T2

Prerequisite: 4.512.

Flow and fracture in metals. Plasticity theory. Principles of metal shaping processes. Relationship between formability and conventional mechanical test results. Fracture mechanics. Fractography. Defects and their significance. Experimental methods related to stress analysis flow and fracture.

4.504 Mechanical and Industrial Metallurgy — S1 L3T0 S2 L3T6

Prerequisites: 4.403 or 4.433, 4.502 or 4.522.

The application of metallurgical principles to industrial processing with particular reference to casting, welding , shaping, properties and selection of materials. Metal finishing. Metallurgical aspects in engineering design. Fracture mechanics, design against fatigue, brittle and ductile fracture.

4.514 Industrial Metallurgy — F3

Prequisites: 4.433, 4.522.

Description as for subject 4.504.

4.602 Metallurgical Engineering I — S2 L3T2

Co-requisite: 4.302.

Mass and energy accounting in metallurgical processes. An introduction to the principles and applications of transport processes in systems with specific reference to industrial processes in primary and secondary metallurgy.

4.604 Metallurgical Engineering III — S1 L5T3 S2 L2T5

Prerequisite: 4.623.

Process dynamics and automatic control: Dynamics of simple linear systems; representation and analysis of some metallurgical processes by linear models; effect of various control elements; analysis by empirical models; design of control systems for metallurgical processes. *Simulation:* Objectives of simulation; analysis of a process into its principal phenomena; mathematical and logical representation of the phenomena; development of the computer program; validation of the program. *Metal Manufacturing Economics:* The economic framework of manufacturing. Types of companies; application of financial analysis to manufacturing; elements of costing and cost control budgeting; allocation of resources; job scheduling; the modelling of a manufacturing unit; project evaluation and control. *Optimization:* As for 48.042 Chemical Engineering IIIB, Unit 2. *Water Pollution Control:* As for the relevant part of 48.043 Chemical Engineering IIIC, Unit 2. Atmospheric pollution control. *Plus a selection from the following topics, to be determined by the Head of School:* Mineral chemistry; testwork design; design of technical information systems; design of sampling procedures; selection of process models; energy utilization and recovery; utilization and disposal of waste materials; safety aspects of metallurgical processes.

An overall aim is the development of a sound method for making technical decisions, in the context of design, through the procedure of specifying criteria, evaluating options, implementing and reviewing the decision. To illustrate the method, case studies of technical decision-making in major industrial projects are presented by the people responsible for the projects.

4.613 Metallurgical Engineering IIA — S1 L2T1

Prerequisite: 4.602.

An extension of the principles and applications of transport processes to metallurgical systems. The principles of metallurgical heating and cooling including fuels, refractories and furnace design and operation. Solidification in moulds, continuous casting. *Process Economics:* As for 48 031 Chemical Engineering IIA Unit 6.

4.623 Metallurgical Engineering IIB — S2 L3T1

Prerequisite: 4.613

Continuous Processes: The application of theoretical models and empirical data to the design of continuous processes involving two or more phases in contact. The principles of instrumentation and their application to research and on-stream measurement in metallurgical plants.

4.624 Metallurgical Engineering Project — F3

(Includes three weeks laboratory work during the mid-year recess.) An investigation of some aspects of metallurgical engineering.

4.703 Materials Science — S2 L2T1

Co-requisite: 4.403.

The application of the principles of physical metallurgy to the development of modern materials. Particular attention is paid to the structure property relationships that determine the design of materials. The topics covered include materials used for structural purposes, high temperature application, corrosive environments, nuclear engineering, fuel cells, magnetic applications.

4.802 Metallurgical Physics — S2 L2T0

Prerequisites: 1.001 or 1.011.

Development of physical principles for application in metallurgy — theory of metal models. Sommerfeld Theory, zone theory, interaction of radiation with matter, solid state devices, instrumentation.

4.813 Mathematical Methods — F L2T1

Prerequisites 10.031 or 10.211A.

1. *10.351 Statistics SM (see Engineering Handbook).* **2.** *Numerical Methods.* Simultaneous linear equations. Solution of non-linear equations. Systems of simultaneous non-linear equations; application to phase equilibria. Finite difference methods: solutions of ordinary and partial differential equations; application to heat and mass transfer. Finite element methods: application to determination of elastic stress and strains. Computing: BASIC language; programming assignments in numerical methods.

4.823 Numerical Methods — F L1T½

Prerequisite: 10.031.

Consists of Unit 2 — Numerical Methods of 4.813 Mathematical Methods.

4.911 Materials Science — F L1T½

The atomic structure of metals. The grain structure of metals; origin; modification. Structure of alloys, theory. Structure, properties and heat treatment of commercially important alloys based on aluminium, copper and iron in particular. Corrosion. Control of structure and properties, commercial alloys, materials selection.

4.913 Materials Science — FL2T1

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. *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.

4.941 Metallurgy for Engineers — F L1T0

Solidification of metals, defects in cast metals, casting methods. Phase equilibrium in alloys. Strengthening mechanisms in metals. Elastic and plastic deformation of crystalline materials; mechanism of slip, dislocations. Fracture mechanism, brittle fracture, fatigue and creep. Corrosion and oxidation of metals. Specification and selection of engineering alloys.

4.951 Materials Technology — F L2T2

Materials selection, based on structure and properties. Equilibrium and kinetics in metallic systems. The structure of ceramics with particular reference to silicates. Structural changes. Electroplating processes considered from a theoretical and practical standpoint. Structure and testing of electro-deposits; electrochemical protection. The structure, properties and technology of wood.

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 material.

4.974 Mining Materials — S1 L1

Specification and selection of materials. Structural and constructional materials for buildings and plant; plain carbon, low and medium alloy steels, non-ferrous alloys; repair and maintenance problems. Materials for mining and minerals processing plant; corrosion and heat-resistant alloys; wear-resistant materials; repair and maintenance. Failure analysis, fracture and corrosion failures. Corrosion prevention.

Graduate Study

4.211G Metallurgical Practice

Detailed studies relating to one or more specialized areas of metallurgical practice such as founding, welding, mineral treatment.

4.221G Advanced Metallurgical Techniques

Lectures and laboratory instruction will be offered in advanced techniques including the following: X-ray metallography; electron microscopy; electron probe microanalysis; quantitative metallography; stress and strain analysis; fracture toughness testing; metal melting and casting; mechanical testing; electrochemical technique; research techniques — physical; research techniques — chemical; mineral investigation techniques.

4.231G Advanced Theoretical Metallurgy

Covers a wide range of theoretical topics drawn from physical metallurgy, chemical and extractive metallurgy, mineral chemistry, physics of metals and mechanical metallurgy.

4.241G Graduate Metallurgy Project

An experimental or technical investigation or design related to a branch of metallurgy.

4.251G Advanced Materials Technology

Principles of materials selection. Selection of materials based on engineering design criteria. Service performance. Modes of failure. Selection based on service performance criteria. Principles of the design of materials. Materials specifications. Acceptance testing. Principles and methods of non-destructive testing. Selection of test methods. N.D.T. laboratory procedure. Service performance analysis. Service failure investigations.

4.261G Modern Microscopy of Materials

Descriptions of light optical and electron optical instruments from the point of resolution, depth-of-field, contrast and additional data obtainable from the specimen as well as the application of these instruments to the study of materials.

4.270G Solid State and Mineral Chemistry — F L2

Principles of crystal chemistry; structures of selected crystal types and glasses. Thermodynamics of solid systems; phase relation. Defects in crystals; non-stoichiometry. Solid state diffusion. Thermodynamics and kinetics of solid state reaction. Hydrothermal reactions.

Stability of compounds at elevated temperatures; effect of heat on clay minerals; hydrothermal reactions between silica and lime; volatility of compounds; reactions in nuclear fileds; solid state electrolytes; biodegradation of rock and minerals. Chemical strengthening of ceramics.

4.271G Refractory Technology I — FLS2T1

Engineering Properties and Application: This subject deals with the philosophy and methods of development of refractories, the thermodynamic stabiltiy and volatility of high temperature materials and the manufacture and testing of refractory materials in industry. A detailed consideration is given to the composition, structure, and properties of typical refractory materials such as silica, alumino silicate, high alumina, basic and sirconia materials and special single and mixed oxides, carbide, nitrides and oxynitrides. Furnace and kiln design is studied with respect to limitations imposed by the refractories used. Laboratory experiments and demonstrations will form part of the course.

Candidates are expected to have a background knowledge equivalent to that expressed in the syllabus for 4.232 Ceramic Engineering I.

4.272G Refractory Technology II — F L2T1

Chemical Property and Service Behaviour: Deals with the study of chemical reactions occurring between refractories and reaction products in typical industrial situations. It will provide a basis for evaluating the predicting refractory performance in the manufacture of ferrous and non-ferrous metals, glass, enamels and cements. A detailed consideration of the chemical reaction occurring between refractories and solid, liquid and vapour phases will be made. Laboratory experiments and demonstrations form part of the subject. Candidates are expected to have a background knowledge equivalent to that expressed in the syllabus for 4.213 Chemical Ceramics (Session 1).

4.281G Chemistry of Glass Melting **S1 or S2 L3T3**

Pre- or co-requisites may be specified depending on student's background.

Glass structure: property relations; melting reactions and rates; refining; analytical techniques; economics of glass compositions; melting and refining agents; process chemistry; chemical durability; glass colour; glass-refractory reactions; phase transformations. Laboratory exercises.

Mechanical and Industrial Engineering

Undergraduate Study

5.010 Engineering A **S1 or S2 L4T2**

Prerequisite:

	HSC Exam Percentile Range Required
Either	
2 unit Science (Physics) or	*31-100*
4 unit Science (multistrand)	*11-100*
or	
2 unit Industrial Arts or	*31-100*
3 unit Industrial Arts	*11-100*

Note: Students who wish to enrol in this subject in courses other than the full-time courses in Aeronautical Engineering, Civil 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.

Statics: Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames, and beams. Simple states of stress. Statics of fluids. *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:* The structure and properties of the main types of engineering materials, with emphasis on the way in which properties may be controlled by controlling structure.

5.020 Engineering B **S2 L4T2 or L/T6**

Prerequisite: 5.0101 or 5.010 or 8.170.

Engineering Dynamics: 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; belt and rope drives; gear trains. Virtual work. Kinetics of a system of particles: impulse and momentum; moment of momentum; impact. Fixed-axis rotation of a rigid body: angular momentum; equation of motion; moment of inertia; energy; centre of percussion. Steady mass flow: theoretical principles; Pelton wheel. *Mechanics of Solids:* Concepts of stress, strain. Stress and deformation due to axial force. Linear and non-linear problems, compound bars. Concepts of stiffness and flexibility. Bending moment and shear force in simple beams. First and second moments of area. Stress and deformation due to bending; linear and non-linear problems; use of step functions.

5.030 Engineering C **S1 or S2 L2T4 or L/T6 or F L/T3**

Prerequisites: as for 5.010.

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* F 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.

5.0301 Engineering Drawing **S1 or S2 L/T3**

Fundamental concepts of descriptive geometry, including reference systems, representation of point, line and plane; fundamental problems of position and measurement. Application of descriptive geometry to certain problems arising in engineering practice. Special emphasis on ability to visualize problems and processes involved in their solution. Instruction in the correct use of drawing instruments and the application of drawing standards. Measurements and dimensioning. Orthographic and isometric projections.

5.0302 Engineering Drawing and Descriptive Geometry **S1 or S2 L1/T3**

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.

5.122 Mechanical Engineering Design II **F L1T2**

Prerequisite: 5.030. Pre- or Co-requisites: 5.330 or 5.0201, 5.622, 5.422 or 8.112, 8.250.

Application of design strategy to creative design projects. Modelling, analysis and design of basic engineering elements and systems with further engineering drawing practice. Review of current available mechanical technology and use of standard equipment items, codes and trade literature.

5.300 Engineering Dynamics IB **S2 L1T1**

Prerequisites: 1.001 or 1.951, 5.0201, 10.001.

Kinematics and kinetics of rigid bodies in planer motion: absolute motion and motion relative to translating and rotating frames of reference; constraint and degree 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.

5.333 Dynamics of Machines **S2 L2T1**

Prerequisites: 5.300 or 5.330, 10.022.

Kinematics and dynamics of planar mechanisms: methods for the analysis of velocities, accelerations and forces in planar mechanisms. Kinematics of gear tooth profiles. Static and dynamic rotor balancing. *Mechanical vibrations:* one degree of freedom systems, free and forced vibrations. Transmissibility and motion isolation. Whirling of shafts.

5.422 Mechanics of Solids II/Materials **F L2T2½**

Prerequisites: 5.421 or 5.040 or 5.020 or 8.171, 10.001.

Mechanical properties of materials: tensile and compressive behaviour; hardness; testing machines. Statics of frames and machines. Unsymmetrical bending. Analysis of stress; analysis of strain; generalized Hooke's Law. Thin-walled pressure vessels. Combined loads. Theories of failure. Stress concentrations and fatigue. Shear stress in beams; shear centre. Stability and buckling of columns. Solidification. Mechanical processing of metals. Phase equilibrium and its application to engineering materials. Fracture, creep, corrosion.

5.622 Fluid Mechanics/Thermodynamics **F L2T2**

Prerequisites: 10.001 or 10.011; 1.951 or 1.001 or 1.011; 5.010 or 5.0101. Co-requisite: 5.300 or 5.330 (for students in Faculty of Engineering only).

Comprises 5.6221, 5.6222, 5.6223.

5.6221 Introductory Thermofluids **S1 L2T2**

Work, energy, power. Units. Systems, states and processes. Flow fields; unsteady and compressible flow. Control mass and volume. Fluid properties: extensive, intensive. Equation of state. Tables of properties. First law of thermodynamics. Non flow processes: reversible, irreversible. Flow processes: energy equation, enthalpy, Bernouli's equation. Momentum equations: linear and rotational. Ideal flow.

5.6222 Fluid Mechanics **S2 L1T1**

Flow measurement: orifice, nozzle, venturi meters, pitot tubes, other flow meters. Dimensional analysis: similitude, dimensionless numbers, methods of analysis. Steady one dimensional flow in ducts: laminar and turbulent pressure loss, friction factor, losses in bends and fittings. Equations of fluid motion. Elementary boundary layer flow, skin friction and decay.

5.6223 Thermodynamics **S2 L1T1**

Ideal processes and cycles, reversibility. The second law of thermodynamics. Entropy. Isentropic processes. Cycles for engines and heat pumps. Energy conversion efficiency. Reciprocating pumps, compressors, engines. Energy analysis, P-V diagrams.

Electrical Engineering and Computer Science

Undergraduate Study

6.611 Computing I **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 IIA — S1 or S2 L3T2

Prerequisites: 6.611 (Pass Conceded (PC) awarded prior to Session 2, 1983, is not acceptable for this subject), 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 I. 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.

6.851R Electronics and Instrumentation — S1 L1T2

Prerequisite: 1.001 or equivalent.

An applications-oriented introduction to electronics. Provides a basis of circuit theory and elementary electronics and then treats filters, frequency response, general amplifier characteristics, operational amplifiers and their use in instrumentation, power supplies, analog computers and their use in modelling non-electrical systems. Included is a project illustrating the application of electrical engineering to other disciplines.

6.852R Electrical Machinery and Supply — S2 L1T2

Prerequisites: 6.851R.

A user-oriented introduction to the usage of electrical power in industry, covering the characteristics and selection of electrical machinery, its interface with the prime power supply, protection, electrical safety and compliance with Australian standards. Included in the subject is a project illustrating the application of electrical engineering to various aspects of industry.

6.854 Electrical Power Engineering — S2 L1T4

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.

Graduate Study

6.458G Decision and Syntactic Systems for Digital Pattern Recognition — C3

Concepts and techniques in decision-theoretic pattern recognition systems with an in-depth study of both non-parametric and parametric methods. Includes: pattern, feature and classification spaces, feature selection, linear discriminant functions and training algorithms; piecewise linear, discriminant functions; decision rules; the Bayes framework, approximation of probability densities; clustering and dimensionality reduction. Structural pattern recognition, including such topics as formal linguistics, primitives, grammar and syntax analysis as a recognition procedure.

6.467G Digital Image Processing Systems, Scene Analysis and Machine Vision — C3

The fundamentals of image processing including such topics as visual perception and the image model; uniform and non-uniform sampling and quantization; image transforms; image enhancement, sharpening and smoothing; image restoration and least squares filtering; image encoding, mapping, quantizing and encoding; image segmentation and description, grammars, languages and similarity. Material oriented towards scene analysis and world models for industrial robots including scenes; labelling; shadows; shape information; structural descriptions and representing knowledge; computer vision for robots.

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. Non-visual communications including speech input-output.

6.580G Image Analysis in Remote Sensing — S1 C3

Prerequisites: 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.

6.587G Computer Techniques in Remote Sensing Image Analysis **S2 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, LASP; implementation of classification methodologies, introduction to image processing hardware and associated operating systems; interactive image processing.

Mining Engineering

Undergraduate Study

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.

7.023 Mineral Process Engineering **S1 L1T1**
7.023R Mineral Process Engineering **F L1**

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.

7.033 Mineralogical Assessment **S2 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.

7.044 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 Engineering **S1 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. Relevance of basic science and engineering subjects to mine design and operation.

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.

7.113R Mining Methods **F L2T1**

The syllabus is as for 7.113 with the addition of the following topics: *Non-entry mining methods and petroleum engineering:* Hydrocarbon accumulation, porosity and permeability of reservoir rocks. Flow through porous media. Darcy's laws. Permeability of beds in series and parallel. Gas solubility. Reservoir energy, volumetric and radial flow calculations. Secondary recovery. In-situ mining of sulphur, salt and potash. Underground leaching, retorting of oil shale, gasification of coal. Marine deposits, off-shore mining methods.

7.114 Geotechnical Engineering **F L1T1**
7.114R Geotechnical Engineering **F L2**

Prerequisites for 7.114: 7.123, 7.113.

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 L2T2**
7.123R Geomechanics **F L1T2**

Prerequisite for 7.123: 10.001. Co-requisite: 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 cutability 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, 8.171, 10.001. Co- or prerequisite: 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
7.133R Mine Transport — S2 L2T½

Transport requirements for minerals, waste, supplies and men. 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
7.142R 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 sub-level 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 L2T1½
7.143R Mine Environment and Safety Engineering — F L2T½

Prerequisites for 7.143: 7.132, 7.142.

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
7.153R Power Supply in Mines — S1 L2T½

Prerequisites for 7.153: 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
7.163R Excavation Engineering — F L1T½

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 cutability. 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.

7.193R Mine Technology — F T4

A program of tutorials and laboratory work as the alternative to concurrent industrial experience. The student is given reading and technical assignments to complement the study of third year subjects in a full-time course.

7.194R Mine Design Practice — F T5

The student is given exercises in the application of mine equipment, and in safety and environmental precautions, to complement the lecture materials in third and fourth years of a full-time course. This is the alternative to concurrent industrial experience.

7.213 Mine Surveying — S1 L1T1
7.213R Mine Surveying — F L1

Prerequisites for 7.213: 10.301 and 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
7.214R Mine Economics and Planning — F L2T1

Prerequisite for 7.214: 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
7.224R Operational Management — F L1T½

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.

7.313 Minerals Engineering Processes — F L1T2

Prerequisites: 25.520 or 25.201, 5.030.

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.

7.313R Mineral Processing — F L2T3

A combination of 7.313, with selected topics from 4.374.

7.314 Mineral Process Technology — F L1T1
7.314R Mineral Process Technology — F L2T1

Prerequisite: 7.313 or 7.313R.

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.

7.414 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.

7.414R Minerals Industry Project F T4

Periods are set aside each week to provide time for the students to consult library references, prepare notes and undertake experimental work. The project supervisor is available for discussion at agreed times but the student is expected to work on his or her own initiative. The only examination is by assessment of a submitted written thesis, which must consist of two parts: a literature survey and a report on research.

The thesis is to be based on a modest, but significant, research project, which may be on some aspects of a staff member's or mine company research interests. Most projects are experimental in nature but some may be largely theoretical.

7.416R Minerals Industry Project F T2

A shorter version of 7.414R above.

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 Mining Engineering. 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.

7.424R Feasibility Studies and Seminars F T2

Group work on the creation of a mining complex from an original mineral deposit with its approximate costing. Appraisal of the result as an investment. The work draws on all other courses and consists mainly of tutorials and seminars by students, and by visiting lecturers. Students are expected to present written technical reports and memoranda for assessment.

7.425 Mining Geology Project S2

7.434 Advanced Mining Laboratory F T1

A program of mining laboratory experiments for Year 4 students, requiring the submission of appropriate laboratory reports.

Graduate Study

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: 7.023.

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: 7.313 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 I — 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 II — 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 sepatators. **4.** Chemical concentration processes: Leaching. Solvent extraction and ion exchange. Cementation. Cyamdation 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 L3

A series of laboratory investigations relating to material covered in subjects 7.361G and 7.362G.

7.364G Minerals Engineering III — 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, nonliability, 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 — S1 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 cutability 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. Probablistic 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.

Civil Engineering

Undergraduate Study

8.021 Environmental Aspects of Civil Engineering — SS L2T1

Prerequisite: 8.301 or 8.312.

Examination of the professional issues arising from the environmental impact of civil engineering planning, design and construction. Methodologies for environmental impact evaluation and general project evaluation. Environmental legislation, institutional procedures and decision-making processes. Case studies and project work in the above context.

8.112 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.

8.171 Mechanics of Solids I — SS L1½T1½

Prerequisite: 8.170. (Students who have failed 8.170 may apply for permission to enrol in 8.170 and 8.171 concurrently).

Applications of laws of static equilibrium to structures. Concepts of stress, strain. Equilibrium, compatibility and stress-strain relationships. Stress and deformation due to axial force; linear and non-linear problems; compound bars. Concepts of stiffness and flexibility, bending moments and shear forces in simple beams. First and second moments of area. Stress and deformation due to bending, linear and non-linear problems; use of step functions and moment area methods.

8.172 Mechanics of Solids II — SS L2T2

Prerequisite: 8.171.

Structural statics. Bending moments, shear force and torsion. Stresses due to shear force in solid and thin-walled sections, shear centre. Torsion of circular, non-circular and thin-walled sections. Principal stresses and strains; yield criteria. Combined stresses. Concepts of instability.

8.250 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.

Graduate Study

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 — 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 — C3

Search, linear programming, non-linear programming, geometric programming, calculus of variations, maximum principle, applications.

8.753G Soil Engineering — C3

Soil pedology, fabric studies. Soil stabilization with cement, lime, bitumen and others. Grouting. Special techniques of piling. Soil anchors, slurry trench design. Freezing and thermal soil treatments. Vacuum and Electro osmotic dewatering. Advanced techniques for the in site measurement of soil properties. Variability of safety factors.

8.776G Rock Mechanics — 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 — 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 — 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.

8.780G Geological Engineering **C3**

Rock stability investigations, mapping of exposed structures, in-site, strength and deformation measurements. Drilling techniques, logging and representation of engineering geological information. Photogrammetric mapping and techniques. Classification of discontinuities in rock and mechanics of faulting and fracture. Strain analysis for rock masses.

8.820G Structural Analysis and Finite Elements I **C3**

Stiffness analysis of structures. Basis of finite elements: Principle of virtual work, variational theorems, constraint equations. Effects of inplane rigid floors and axially rigid members on the behaviour of multi-storey frames.

8.833G Free Surface Flow **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 **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 **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 **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 **C3**

Confined and unconfined aquifers, analogue and digital models of aquifer systems, water movement in the unsaturated zone, recharge, groundwater qualify, sea water intrusion.

8.843G Groundwater Hydraulics **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 **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 **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 **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 **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 I **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 II **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 **S1 or S2 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.

8.909G Project **C9**

A minor research investigation involving analysis and interpretation of data, or a critical review and interpretation of literature on a selected topic, or a design project.

8.918G Project Report **C18**

As for 8.909G but involving more substantial investigation.

Wool and Pastoral Sciences

Undergraduate Study

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 School of Wool and Pastoral Sciences, other University schools and research organisations. 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 I — F L2T1

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. Crossbreeding, 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 II — 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 III — 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 I — 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 II — 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 L2T2

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 I — 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 (a) the theory of production economics, which provides the background for many of the tools of

applied farm management; and (b) price theory with emphasis on agricultural markets.

The management planning strand emphasises 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 II — 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 — (i) Response surface estimation and analysis; (ii) Linear programming methods, with an introduction to other mathematical programming methods; (iii) Systems analysis and simulation methods.

9.412 Agricultural Chemistry II — F L2T4

Prerequisite: 2.003J.

Proximate analysis of feeding stuffs, calorimetry, further work on fats, carbohydrates and proteins. Autoxidation and relationship to loss of animal nutritional factors. Antioxidants, natural and synthetic; correlations of *in vitro* and *in vivo* action to tocopherols and organo-sulphur and selenium compounds. Protein homogeneity, enzyme separation and assay. Sulphur reactions of proteins; thiolation and grafting. Free radical and ionic reactions of disulphides. Sulphydryl-disulphide interchange and displacement reactions. Partial oxidations.

Animal milks, analysis and heat treatment changes and detection. Roles of trace metals in biological processes, metal complexes with proteins and metal catalysis.

Anthelmintics; oxidation products and possible origin. Fungicides and herbicides, formulation and survey of commercial materials. Analysis and trace residue detection. Vitamins, enzymes and hormones. Photo-chemistry, energy transducers. Isotope techniques.

9.421 Animal Nutrition — S2 L3T1

Composition and classification of foodstuffs and pastures. Physiolgy 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 I — F L4T3

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 II — 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 III — 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.

9.601 Animal Physiology I — S1 L3T3

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.

9.602 Animal Physiology II — F L2T2

Prerequisite: 9.601.

Neuroendocrinology and reproductive physiology. Physiology of lactation and growth. Physiology of digestion. Environmental physiology. Water and electrolytes. The application of physiology in research.

9.801 Genetics I — 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 II — 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 I **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 II **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.

Graduate Study

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.

Mathematics

Undergraduate Study

10.001 Mathematics I **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 I **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 IB — 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 IC — 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 II — 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.

10.111A Pure Mathematics II — Linear Algebra — F L1½T1

Prerequisite: 10.001 or 10.011. Excluded: 10.121A.

Vector spaces, linear transformations and matrices, change of basis. Eigenvalues and eigenvectors, generalised eigenvectors. Functions of matrices. Linear systems of differential equations including the use of Laplace transform. Inner products, orthogonalisation, projections. Unitary and self-adjoint transformations. Quadratic and Hermitian forms.

10.1113 Pure Mathematics II — 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.

10.1114 Pure Mathematics II — Complex Analysis — S1 or S2 L1½T1

Prerequisite: 10.001 or 10.011. Excluded: 10.1214.

Analytic functions, Taylor and Laurent series, integrals. Cauchy's Theorem, residues, evaluation of certain real integrals.

10.121A Higher Pure Mathematics II — Algebra — F L2T½

Prerequisite: 10.011 or 10.001 (DN). Excluded: 10.111A, 10.1111.

Linear Algebra: vector spaces, commutative rings, polynomials, modules, linear transformations, eigenvectors, invariant subspaces, canonical forms, linear functions, bilinear and multi-linear algebra. Group Theory: subgroups, quotient groups, isomorphisms,Lagrange's theorem, Sylow's theorem.

10.1213 Higher Pure Mathematics II — Multivariable Calculus — S1 L2T½

Prerequisite: 10.011 or 10.001 (DN). Excluded: 10.1113.

As for 10.1113 but in greater depth.

10.1214 Higher Pure Mathematics II — Complex Analysis — S2 L2T½

Prerequisite: 10.1213. Excluded: 10.1114.

As for 10.1114 but in greater depth.

10.2111 Applied Mathematics II — Vector Calculus **S1 or S2 L1½T1**

Prerequisite: 10.001 or 10.011. Excluded: 10.2211, 4.813.

Vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss' and Stokes' theorems. Curvilinear co-ordinates.

10.2112 Applied Mathematics II — Mathematical Methods for Differential Equations **S1 or S2 L1½T1**

Prerequisites: 10.001 or 10.011. Excluded: 10.2212, 4.813.

Series solution or ordinary differential equations; numerical methods. Partial differential equations: separation of variables. Fourier series, Bessel functions.

10.2211 Higher Applied Mathematics II — Vector Analysis **S1 L1½T1**

Prerequisite: 10.011 or 10.001 (DN). Excluded: 10.2111.

As for 10.2111 but in greater depth.

10.2212 Higher Applied Mathematics II — Mathematical Methods for Differential Equations **S2 L1½T1**

Prerequisite: 10.2211. Excluded: 10.2112.

As for 10.2112 but in greater depth.

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.

10.331 Statistics SS **F L1½T½**

Prerequisite: 10.001 or 10.021C (CR). Excluded: 10.311A, 10.311B, 10.321A, 10.321B, 10.301, 45.101.

An introduction to the theory of probability, with finite, discrete and continuous sample spaces. The standard elementary univariate distributions: binomial, Poisson and normal; an introduction to multivariate distributions. Standard sampling distributions, including those of χ^2, t and F. Estimation by moments and maximum likelihood (including sampling variance formulae, and regression); confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to experimental design; fixed, random and mixed models, involving multiple comparisons and estimation of variance components.

Psychology

Undergraduate Study

12.100 Psychology I **F L3T2**

Excluded: 12.001.

An introduction to the content and methods of psychology as a basic science, with emphasis on the biological and social bases of behaviour, relationship to the environment, and individual differences. Training in the methods of psychological enquiry, and in the use of elementary statistical procedures.

Textile Technology

Undergraduate Study

13.111 Textile Technology I **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 II **F L5T7**

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 III — F L4½T2

Part A. Testing and Yarn Manufacture: Functions of quality control. The organisation 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 I — 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 II — F L2

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 III — F L2T2

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

Chemistry of amino acids and proteins. Photochemistry of fibres and dyes. Physical-chemical concepts of dyeing.

13.233 Advanced Textile Physics — F L2

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: 1.533 Biophysical Techniques, 1.3033 Mechanical Properties of Materials, 1.3133 Electrical, Optical and Thermal Properties of Materials.

13.311 Textile Engineering I — 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 II — F L1½

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

(a) Same as (a) in 13. 233 Textile Physics.

(b) 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.

Accountancy

Undergraduate Study

14.501 Accounting and Financial Management IA — 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 taxation and auditing.

14.511 Accounting and Financial Management IB — S1 or S2 L2T2½

Prerequisite: 14.501.

Development of basic concepts introduced in 14.501 Accounting and Financial Management IA, including management accounting and operations research, corporate reporting, business finance, system design, elementary computer programming and applications.

Economics

Undergraduate Study

15.001 Microeconomics I — S1 or S2 L2T1½

Commerce/Arts/Applied Science/Sciences Prerequisite:

	HSC Exam Percentile Range Required
2 unit A English or	*31-100*
2 unit English or	*21-100*
3 unit English	*11-100*

Introduction to micro-economic analysis and its application to contemporary policy issues. Indifference curve approach to consumer behaviour, income and substitution effects, market demand, consumer surplus. Isoquants, cost concepts, supply curves. Perfect and imperfect product markets, agricultural intervention schemes. Partial and general equilibrium, concept of efficiency, international trade and tariffs. Productivity of factors of production, labour markets, bilateral monopoly, wage fixing in Australia. Public goods, pollution and property rights.

15.002 Microeconomics II — S1 L2T2

Commerce/Arts/Applied Science/Sciences Prerequisites: 15.011 plus

	HSC Exam Percentile Range Required
2 unit Mathematics or	*51-100*
3 unit Mathematics or	*21-100*
4 unit Mathematics	*1-100*

Excluded: 15.012, 15.072

Revealed preference theory of demand, index numbers and aggregation; externalities, time preference, consumer surplus and compensation concepts. Short and long-run costs, returns to scale, producer surplus and quasi-rents. Monopolistic competition, oligopoly, cartels, public enterprise. Investment criteria, benefit-cost analysis. Efficiency and equity trade-offs, microeconomic policy in a second best framework.

15.003 Macroeconomics III — S1 L2T2

Commerce/Applied Science/Science Prerequisite: 15.042.

Macroeconomic theory and policy including an introduction to the theory of economic policy, the structure and dynamic characteristics of macro-models, recent developments in monetary theory and policy, theories of inflation and policy in a dynamic setting.

15.011 Macroeconomics I — 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 II — S2 L2T2

Commerce/Arts/Applied Science/Sciences Prerequisites: 15.011 plus HSC results as for 15.002. Excluded: 15.052, 15.062.

Extensions to the Keynesian model of income determination to include the government and overseas sectors and a more detailed examination of both demand and supply functions; money and financial institutions; an introduction to dynamic economics.

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/Science Prerequisite: 15.011. Excluded: 15.052.

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 — S2 L2T1

Commerce/Applied Science/Sciences Prerequisite: 15.002 or 15.012 or 15.072.
Arts Prerequisites: 15.103 or 15.113 or 15.062 and 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.

15.082 Labour Economics — S1 L2T1

Commerce/Applied Science Prerequisite: Any Year 2 economics subject.
Arts Prerequisites: 15.002 or 15.062 or 15.072 plus 15.402 or 15.421.

Not offered in 1984.

Theories of the labour market and segmented labour markets and applications to the Australian situation, including labour supply and demand with emphasis on structural changes in the labour force, and the effects of technology and migration; work-leisure preferences, job satisfaction and worker participation; unemployment and under-employment, wage theory and practice, with reference to market forces, collective bargaining and government regulation; the Australian Arbitration System and its interaction with other wage determinants; wage differentials.

15.083 Public Finance — S2 L2T1

Commerce/Applied Science Prerequisite: 15.002 or 15.012 or 15.072.
Arts Prerequisites: 15.002 or 15.072 plus 15.402 or 15.421.

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 L2T1

Commerce/Arts Prerequisite: 15.002 or 15.012 or 15.072.
Applied Science Prerequisite: 15.002 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.

15.103 International Economics — S2 L2T1

Commerce/Applied Science/Sciences Prerequisite: 15.002 or 15.012.
Arts Prerequisites: 15.002 or 15.072 plus 15.402 or 15.421.
Excluded: 15.113.

The International economy, Australian balance of payments, international institutions. Comparative costs, gains from trade, effects of resource endowments on trade. Government intervention, including tariffs and quotas. Customs unions. Foreign exchange markets. Foreign investment. Balance of payments adjustment mechanisms, internal and external balance. International monetary system. Foreign aid. Proposals for a new international economic order.

15.143 Microeconomics III — S2 L2T2

Commerce/Applied Science/Sciences Prerequisite: 15.002 or 15.012.

Characteristics approach to demand theory, uncertainty, portfolio choice. Linear programming approach to the theory of the firm. Managerial and growth models of the firm. Multinational firms. Technological change. Market dynamics, expectations, speculation and futures markets. Input-output analysis, general equilibrium and welfare. Classical and neo-classical theories of income distribution. Income distribution in Australia.

15.163 Industry Economics and Australian Industrial Policy — S2 L2T1

Commerce/Applied Science Prerequisite: 15.002 or 15.012 or 15.072.
Arts Prerequisites: 15.402 or 15.421 plus 15.072 or 15.012 or 15.002.

Structure of industry; interrelationships 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).

15.501 Introduction to Industrial Relations — S2 L2T1

For students enrolled in Faculties other than Commerce and Arts. Designed to provide a practical introduction to important industrial relations concepts, issues and procedures. Includes: the origins, evolution and operation of the Australian system of industrial relations; the structure and role of trade unions and employer bodies; the function of industrial tribunals such as the Australian Conciliation and Arbitration Commission and the NSW Industrial Commission; wages structure and determination; employment, unemployment and retraining; the nature and causes of strikes and other forms of industrial conflict; the processes and procedures for conflict resolution.

Where appropriate to class composition, particular attention is paid to individual industries.

For further information regarding the following subject see the Faculty of Arts Handbook.

15.666 Australia in the International Economy in the Twentieth Century — S1 or S2 L2T1½

Commerce/Applied Science/Sciences Prerequisite:

	HSC Exam Percentile Range Required
2 unit A English or	*31-100*
2 unit English or	*21-100*
3 unit English	*11-100*

The international economy at the end of the nineteenth century: trade, factor flows, and payment arrangements. Problems of the international economy between the wars. The impact of World War II and the international economy in the post-war era. Australian economic development and its relationship with the international economy; economic fluctuations; problems of the inter-war period; growth of manufacturing; government policy and action; the importance of the mining industry; economic development and the distribution of income and wealth.

15.777 Management Strategy and Business Development — S2 L2T1½

Commerce/Applied Science/Sciences Prerequisite: 15.601 or 15.666.

The strategy and structure of large scale business enterprise over the past century. An analysis of the process of growth from small family firms and partnerships to corporate enterprises and multinational corporations. The external business environment. Case studies of managerial hierarchies, investment strategy and diversification of firms in transport, mass retailing and mass production.

Biological Sciences

Undergraduate Study

Students must pay the laboratory fee and then use the receipt to obtain a 'course guide' during Orientation Week from the Biology Information Centre, Laboratory A, Ground Floor, Biological Sciences 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

Undergraduate Study

18.121 Production Management — F L3T0

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.

18.131 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, simluation.

18.551 Operations Research — F L2T1

Prerequisites: 18.603 or 18.121, 5.072 or 10.031 or 10.331.

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.

Nuclear Engineering

Undergraduate Study

23.051 Nuclear Power Technology — F L2½T½

Atomic nuclei, radioactivity, neutron reactions, fissile and fertile materials, nuclear conversion and breeding cycles, plutonium. Criticality requirements, heat removal, control and safety of nuclear reactors. The thermal, hydraulic and structural aspects of gas and liquid cooled thermal reactors and liquid metal cooled fast breeder reactors. The status of fusion research and development. The technology, safety, economics and environmental impact of nuclear fuel cycles, from mining, through enrichment, fabrication and burnup to waste disposal. Comparative assessment of nuclear, fossil and alternative energy systems in local and global contexts.

Applied Geology

Field tutorials are an essential part of these subjects, and are held during weekends and/or recesses. Dates and costs are available during the first week of the subject. Attendance is compulsory.

Undergraduate Study

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.

25.112R Geology for Mining Engineers IIA

Prerequisite: 25.520.

Elements of stratigraphy, palaeontology and petrology. Environments of formation and tectonic setting of sedimentary, metamorphic and igneous rocks. Descriptive structural geology. Interpretation of geological maps. Ore genesis. Descriptive mineralogy of ore deposits. Introductory mineragraphy. Weathering and element redistribution. Geological, geochemical and geophysical aspects of exploration. Processing of exploration data. *Laboratory Work:* Examination of rocks in hand specimen and thin section. Examination of hand specimens of economic minerals. Mineragraphic examination of ore mineral suites. Study of geological maps of economic mineral deposits.

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.

25.122R Geology for Mining Engineers IIB

Prerequisite: 25.520.

Structural geology. Wulff and Schmidt net problems and rose diagrams. Applications of structural analysis in the study of structure of ore deposits and mine design. Regional stress distribution in rock masses. Residual stress fields. Occurence of placer ore deposits. Descriptive mineralogy of non-metallic deposits such as phosphates, clays, shales, limestones, rock construction materials, abrasives, and refractories. Groundwater geology: pressure, flow and storage of water in rocks, with particular reference to fissured rock masses. Energy resources: the geology of coal, oil, natural gas, uranium and geothermal power. Sampling: statistics, errors, limitations and methods. *Laboratory Work:* Exercises in structural analysis including the analysis of structure of an ore deposit. Hand specimen examination of non-metallic economic minerals. Exercises in groundwater hydrology.

25.201R Mineragraphic Laboratory Work

Comprises the mineralogy and Introductory Mineragraphy topics from 25.112R Geology for Mining Engineers IIA.

25.211 Earth Materials I — 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 crystallisation and differentiation. Partial melting. Simple binary melting diagrams. Igneous petrology relating to place tectonics. *Practical:* Macroscopic and microscopic examination of rock forming and ore minerals and igneous rocks in the field and the laboratory. *Field Work* of one day is a compulsory part of the subject.

25.212 Earth Environments I — 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 II — 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 chemically formed sedimentary rocks including the phosphates, zeolites, 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 eight 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 I — 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.

25.301R Geoscience IIIA — F 3 hpw

Stratigraphy, palaeontology, oceanography.

25.302R Geoscience IIIB — F 3 hpw

X-ray crystallography, mineralogy, metamorphic petrology, structural geology, tectonics.

25.303R Geoscience IIIC — F 3 hpw

Igneous petrology, geochemistry, clay mineralogy, sedimentary petrology.

25.304R Geoscience IIID — F 3 hpw

Economic geology, mathematical geology, geophysics.

25.311 Earth Materials III — 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:* Some modern methods of rock and mineral analysis. Accuracy, precision and quality of geochemical data. The distribution of elements in terrestrial rocks. Norms. *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.

25.321 Earth Materials IV — 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. *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 are 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.

25.312 Earth Environments II — 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 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 eight days is a compulsory part of the subject.

25.314 Mineral and Energy Resources I — S1 L3T3

Prerequisite: 25.221.

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 speci-

mens, 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 four days is a compulsory part of the subject.

25.3162 Mathematical Geology II — 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 IV — 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. *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 II — S2 L3T3

Prerequisite: 25.212.

Non-metallic Resources: Geological factors critical to the occurrence of oil, natural gas, oil shale and coal. Geochemistry of hydrocarbons and formation fluids. Typical Australian and overseas occurrences of petroleum. Techniques of petroleum exploration, assessment and development of reserves. Introduction to coal petrology. Geological controls on the formation and distribution of coal. Occurrence and economic use of non-metallic products including phosphates, bauxites, beach sands and industrial minerals. *Sedimentary Basin Analysis:* Techniques of analysis and data presentation using information from outcrops, boreholes (including wireline logs) and seismic sections. Construction and interpretation of structural, isopachous and lithofacies maps. Seismic stratigraphy. Styles of sedimentation within and structuring of basins in tensional, compressive and strike-slip tectonic regimes. Basin evolution. *Field Work* of one day 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 — S1 L1T1

Prerequisite: 25.311.

Modern destructive methods of rock and mineral analysis. Non-destructive methods; X-ray fluorescence spectroscopy and electron probe microanalysers.

25.3271 Advanced 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 three 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 School.

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. *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.

25.520 Geology for Mining Engineers I

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.

Sedimentology, as in 25.212 Earth Environments I. Available only to Course 3145.

25.523 Mineralogy

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 II

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 of coal, oil and natural gas; stratigraphic and structural considerations of oil and coalfields. *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.

25.5311 Aqueous Geochemistry S1 L0

Prerequisite: 25.221.

Aqueous Geochemistry, as in 25.311 Earth Materials III. 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.

Field Mapping, as in 25.312 Earth Environments II. Available only to Course 3145.

25.5313 Stratigraphy

Prerequisite: 25.5212. Excluded: 25.312

Stratigraphy, as in 25.312 Earth Environments II.

25.532 Advanced Engineering Geology

Prerequisite or co-requisite: 8.272.

The fabric of rocks at various scales; fabric analysis at the mesoscopic scales; the influence of anisotropy on rock properties, engineering applications. The role of geological structure in determining the stability of slopes and excavations; probability analysis of structures in slope studies; case histories. Petrology of rock and earth construction materials; fabric changes with weathering; soil fabrics; engineering aspects, and engineering classification of weathered rocks.

25.542 Mining Geology Project S2

25.9311 Gravity and Magnetic Methods S1 L2T1

Prerequisites: 1.001 and 10.001.

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. Physiclal/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 T1 5

Qualitative and quantitative appraisal of geophysical data for a selected area.

Servicing Subjects

These are subjects taught within courses offered by other schools or departments in a different faculty.

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 2501, 5831.

25.414 Mineral Resources

See Mineral Resources strand in Applied Science Course 3000 Applied Geology Year 4. Available only to programs 2501, 5831.

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 2501, 5831.

25.434 Geology Honours (Single Major)

25.621 Marine Geology I — F L1T2

Prerequisites: 25.601 or both 25.110 & 25.120.

The form and nature of ocean basins; the origin, transport, distribution and deposition of suspended matter in ocean water. Principal groups of oceanic index fossils. Igneous and sedimentary rock types of the ocean floor and their significance. Tectonics of ocean basins. *Field Work* of two days is a compulsory part of the subject.

25.622 Hydrological and Coastal Surveying — F L1T2

Prerequisites: None.

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 II — F L1T2

Prerequisite: 25.621.

Sedimentary and tectonic processes of the ocean basins and continental margins; 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. Magnetism and palaeomagnetism. *Field Work* not exceeding two days is a compulsory part of the subject.

25.632 Estuarine Geology — S1 L1T2

Prerequisite: None.

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. Methods of subsurface analysis.

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.

25.635 Marine Resources — F L1T2

Prerequisite: 25.621. Co-requisite: 25.631.

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. Off-shore drilling.

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 2501, 5831.

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.

Graduate Study

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, R.Q.D., 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.

**Equivalent contact hours, but also including fieldwork out of session.

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* Sem 2**

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 I **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.

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 I **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.

*Weeks 1-7 only.

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.

25.815G Resource Economics II **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 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 II **S1† L2**

Specialized search techniques for selected types of metallic ores, with appropriate case histories.

*Weeks 1-7 only.
†Weeks 8-14 only.

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.

25.813G 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.

†Weeks 8-14 only.

25.840G Seminar **S1† Sem2**

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 projected on some aspect of the hydrogeology of an arid region.

Geography

Undergraduate Study

27.111 Applied Physical Geography I **F L2T3**

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*

Excluded: 27.301, 27.311, 27.801, 27.811.

A systematic introduction to physical geography as a basis for applied studies. Principles of meteorology and climatology with particular emphasis on climatic controls at global and regional scales. Weather systems and forecasting methods. Climatic classification and the regional pattern of climates in Australia. Geologic and climatic factors in landforms and soils, and in the physiographic build and major landforms of Australia. Mass movement and hillslope form. River action and associated valley and channel forms. Coastal environments, processes and forms. Properties and types of soil, 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. Spatial organization of plants and animals, and factors and processes relating to that organisation. Composition, structure, population dynamics and classification of vegetation. *Laboratory classes* concerned with the interpretation of various forms of data in physical geography and their representation quantitatively and graphically. *Field work* of up to three days is an integral part of the subject.

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 — S1 L2T3

Prerequisites: 27.111 or any two units from 2.111, 2.121, 2.131, 2.141, and 27.811 or 27.111 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 — S2 L2T3

Prerequisites: 27.311/811 or 17.031 & 17.041 or 27.111.

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, 27.311/811 or 25.110 & 25.120 or 17.031 & 17.041 or 27.111.

Physical bases 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.

27.162 Geographical Statistics and Computing — S1 L2T2 S2 L1T1

Fundamental concepts in descriptive statistics and univariate inferential statistics; introduction to bivariate and multivariate statistics. Computer-compatible data assembly and storage; standard analysis with computer packages; simple BASIC and FORTRAN programming, typical case studies in Physical Geography exemplifying the above techniques.

27.163 Methods in Physical Geography — F L1

Research design and data sources for studies in physical geography. Quantitative methods having application over several areas in physical geography, including forms of multivariate analysis, time series analysis, use of stochastic models including Markov applications, numeric taxonomic methods and simulation. Laboratory work includes use of CYBER and HP30 facilities. In Session 2 students undertake a project in their specialist areas based upon an application of one of the basic methodologies studied in Session 1.

27.1711 Introduction to Remote Sensing — S1 L2T1

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.

27.1712 Remote Sensing Applications — S2 L2T1

Prerequisite: 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.

27.172 Environmental Measurements — F L2T4

Prerequisite: 27.111.

Sampling strategies and survey methods for the collection of environmental data. Data analyses using laboratory and statistical methods. The collection and analyses of weather and climatic data, and the maintenance of meteorological stations. Methods of field surveying and instrumentation for the study of geomorphologic and hydrologic processes. Drainage basin morphometry, dynamics and function, including controls on run-off and sediment transport. The measurement of soil physical and chemical properties in the field and laboratory with special reference to plant growth and soil water and geomorphological processes. The relationships between weathering processes and soil properties. Methods of surveying, classifying and mapping soils. Measurement and description of vegetation. Vegetation survey, sampling and species abundance measure. Monitoring energy and nutrient flow and the effects of man on ecosystems.

27.183 Geomorphology — S1 L2T3

Prerequisites: 25.110 & 25.120 or 27.311/811 or 27.111. 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 man's 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.

27.193 Environmental Impact Assessment — S1 L1½

Rationale and basic objectives standardized types of Environmental Impact Assessment (EIA), including Matrix Approach, adopted methods of EIA in NSW and other Australian states. Frequently used assessment techniques and their limitations meteorological, hydrological, biological, socio-economic. Environmental decision making and planning under conditions of uncertainty. Local case studies exemplifying various techniques and issues. Trends, changes and likely future developments in EIA. Practical exercises representing components of typical EIAs.

27.194 Assessment and Management of Physical and Biological Resources — S1 L6T6

A core of study relating to methods of assessment of resources and of natural and man-made environments; assessment of land capability and conservational management; evaluation of risk from natural hazards, application of remote sensing for mapping and assessing land, water and biological resources; investigational procedures relating to community and governmental perception and response. This core is supplemented by study in *two* of the following areas, chosen as to suit the project:

1. *Landforms:* Methods of classifying and mapping land surface elements. Physiographic factors in catchment hydrology and flooding. Accelerated erosion and methods of monitoring and controlling it. **2.** *Soils:* Methods of classifying and mapping soils. Movement of water and nutrients through soils and problems of physical and chemical instability with differing land use. Soil properties in relation to the stability of natural or introduced ecosystems. **3.** *Vegetation:* Quantitative analysis of vegetation. Survey, classification, ordination and mapping of vegetation. Identification of environmental controls determining the distribution of vegetation communities and of individual component species. Biogeographic principles of reserve planning. Exploitation of population and population characteristics in pest control strategy. Organisms as indicators of environmental quality. **4.** *Bioclimate* (offered subject to availability of staff): Classification and assessment of climate in relation to natural and agricultural ecosystems. The energy and mass budgets of distinctive plant communities and the aerial and soil microclimate of plant and animal habitats. Climatic factors in plant and animal disease incidence, and in the growth and spread of insect populations. Quantitative models for biometeorological forecasts and the assessment of biological productivity and phenology.

27.423 Environmental Impact Evaluation — F L1T3

Rationale and basic objectives; principal methods of impact evaluation; techniques for assessing impacts of resource developments on physical and socio-economic environments. Australian and overseas legislation and procedures. Environmental decision making and planning under conditions of uncertainty. Practical work focusses on local case studies exemplifying the use of various techniques and approaches to environmental impact assessment and evaluation.

27.433 Geographic Data Analysis — F L1T2

Principles of research design, field survey methods, and exploratory data analysis. Numerical taxonomy, multivariate methods, and categorical data analysis. Introduction to additional computer software and applications.

27.432 Computer Mapping and Data Display — S1 L1T2

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.

27.494 Assessment of Human and Physical Resources — S1 L6T6

A core of study relating to methods of assessment of resources and of natural and man-made environments, land capability, and risk from natural hazards. In addition to the core component, students select *one* area from those listed under 27.194 Assessment and Management of Physical and Biological Resources, and *one* of the following: **1.** *Resource Planning and Decision Making:* Quantitative methods of resource evaluation in relation to urban and regional development, forecasting the social and economic requirements and impacts of resources projects and policies; planning and conflict resolution methods. **2.** *Human Resources:* Examination of the potential of populations for economic development, and the implications of demographic structure for economic growth, energy needs, and housing and service requirements, stressing the skill potentials or deficiencies of sub populations, and emphasising regional aspects.

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.

27.514 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.

27.611 Applied Economic Geography I — F L2T3

Prerequisite:

	HSC Exam Percentile Range Required
2 unit English (general) or	*31-100*
2 unit English or	*21-100*
3 unit English	*11-100*

Consists of four modules each of which emphasises the acquisition and practical application of basic skills and concepts in the solution of typical problems in economic geography, with particular reference to resources development. Stress on Australian case studies. Laboratory classes emphasize the handling and presentation of data in economic geography, the interpretation of spatial data, and elementary problem solving.

27.612 Applied Economic Geography IIA — S1 L2T3

Focus on 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.

27.613 Applied Economic Geography IIIA — S1 L2T3

Selected topics in applied economic geography with particular reference to urban and regional analysis and planning.

27.622 Applied Economic Geography IIB — S2 L2T3

Analysis of the population dynamics of small towns and regions, with emphasis on the measurement and forecasting of change, and on problems of service provision and infrastructure support for subpopulations with different requirements. Stress on problems and policies in non-metropolitan areas of New South Wales.

27.623 Applied Economic Geography IIIB — S2 L2T3

Selected topics in applied economic geography with particular reference to the spatial implications of economic, social and technological change.

27.624 Geographic Thought and Perspectives — S1 T3

Aspects of social science theory and philosophy as they relate to the development of human landscapes and as they enter into planning and policy making. *Themes to include:* The persistent utopian element; utilitarianism and positivist economic geography; conflict approaches; value-critical stances; the political economy critique; participation, advocacy and action-research; humanistic and welfare approaches; ideology and planning; theories of the state and the basis for intervention.

27.632 Geographic Data Analysis II — F L2T2

Focus on inferential statistics and hypothesis testing in the analysis of spatial data and the application of multivariate methods in economic geography. *Laboratory work* is based on the use of SPSS and other statistical packages with particular reference to the major techniques used in geographical analysis.

27.633 Geographic Data Analysis III — 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.

27.641 Data Processing Systems — F L1

The acquisition of basic knowledge and skills for the effective use of the University's mainframe computer network, including command languages, editing systems, an introduction to FORTRAN, SPSS procedures, and related matters.

27.642 Mathematical Methods for Spatial Analysis — F L1T2

Offered subject to availability of staff.

The application of selected mathematics to spatial problems including: Algebra of space and principles of system description using concepts of co-ordinate geometry; quadrat analysis and network theory; matrix algebra and the use of matrices in spatial analysis; differential and integral calculus in modelling geographic systems; optimization methods — constraint maximization; algorithmic methods including linear programming; stochastic processes.

27.644 Seminars in Applied Geography — S1 T4

Seminars on selected topics relating to problems of rural areas: urban land-use; spatial activity systems; and regional problems and planning.

27.652 Geographic Information Systems — S2 L2T1

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

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 — S2 L2T1

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.

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

Not offered in 1984.

Regional forecasting and techniques for evaluating regional plans are emphasised. 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 S2 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 S1 L2T3

Not offered in 1984.

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.

27.773 Spatial Aspects of the Housing Market S1 L2T3

Offered subject to availability of staff.

Advanced residential location theory; housing market models; determinants of house prices and the cost of housing; residential growth on the urban fringe; inner city housing and urban renewal. Housing problems in Australia and the determination of housing policy.

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 schools or departments in a different faculty.

For further information regarding the following subjects see the Faculty of Architecture, Arts, Commerce, Engineering and Combined Sciences Handbooks. Subject numbers beginning 27.3 refer to the Combined Sciences Handbook, numbers beginning 27.8 refer to all other handbooks listed.

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.

27.604 Geography IV (Honours) F

Prerequisite: 27.880.

Honours students in their final year are required to prepare a thesis of not more than 20,000 words and to attend a series of seminars on their thesis and supporting topics. The thesis topic must be approved by the Head of the School during second half of the year *preceding* entry into the final year, while the thesis must be submitted before the examination period in November of the final year. It is expected that research work for the thesis is undertaken during the summer vacation preceding the final year. In addition, students are required to undertake advanced studies in a branch of geography appropriate to the area of research chosen for the thesis.

27.301 Introduction to Physical Geography S1 L2T2½
27.801 Introduction to Physical Geography S1 L2T1½

Prerequisite: Nil. Excluded: 27.111.

Themes selected from the mechanisms of the physical environment, with particular reference to Australia and to the Sydney Region; landscape as an expression of dynamic response. *Energy and Atmospheric Circulation over Australia:* local climate and weather patterns. *Climate-related Problems:* the hazards of fire and flood. *Geological Control of Landform Character:* the development and stability of hillslopes. *Soil, Vegetation and Drainage Relationships:* soil erosion. *The Coastal Ecosystem:* problems of risk and management in the coastal zone. *Lectures* are supplemented with tutorials, laboratories and a field tutorial. Students are required to provide some materials for practical work and to contribute towards the cost of the field tutorial.

27.302 Introduction to Human Geography S2 L2T2½
27.802 Introduction to Human Geography S2 L2T1½

Prerequisite: Nil.

Human geography as a problem-oriented and policy-relevant endeavour. Themes from the development and current state of human landscapes in Australia including aspects of growth and decline in the settlement system, utilization of agricultural and mineral resources and associated impacts, human aspects of environmental management and the spatial impacts of economic, social and technological change. *Lectures* are supplemented by tutorials, laboratories and a field excursion.

27.311 Physical Geography S2 L2T2½
27.811 Physical Geography S2 L2T2½

Prerequisites: 27.301/801, 27.2813 (in special circumstances a student may apply to the Head of School for permission to take 27.2813 as a co-requisite). Excluded: 27.111.

Emphasising inter-dependence of climate, hydrology, landforms, soils and vegetation in major zones. Classification of climates and world climatic patterns. Soil zonality and world soil patterns. World vegetation types and distribution, and their controls. Studies of selected zones with particular reference to the Australasian region. *Laboratory classes:* climatic analysis and mapping, and analysis of natural landscapes, including airphoto interpretation, together with appropriate statistical exercises.

27.312 Human Geography S1 L2T2½
27.812 Human Geography S1 L2T1½

Prerequisites: 27.302/802, 27.2813 (in special circumstances a student may apply to the Head of School for permission to take 27.2813 as a co-requisite).

The urbanization process in underdeveloped and industrialized societies. Theories, concepts and principles relating to the location, size and spacing of settlements; the economic and social structure of urban areas; city-region relationships. Geographical perspectives on contemporary urban problems are offered, particularly those associated with the concentration of people and activities between regions and within cities; emphasis on spatial variations in housing, employment and service provision. *Laboratory classes:* case studies, methods of analysis and practical applications in the local region including a compulsory field excursion equivalent to sixteen tutorial hours.

27.2813 Geographic Methods SS L1T2

Prerequisites: 27.111 or 27.301 or 27.801 (in special circumstances a student may apply to the Head of School for permission to take 27.2813 as a co-requisite) and 27.302 or 27.802.

Statistical procedures used in both human and physical geography. Includes: measures of dispersion; samples and estimates; hypothesis testing; association; correlation and regression; tests for distribution in space; data collection and analysis.

27.2814 Geographic Field Methods S2 T2

Prerequisites: 27.111 or 27.301 or 27.801 & 27.301/801, 27.2813.

Field methods as used in both human and physical geography. The subject involves a three-day field tutorial and associated laboratory work.

27.324 Spatial Population Analysis S2 L2T2
27.824 Spatial Population Analysis S2 L2T1

Prerequisite: 27.312/812, or (for non-majoring Arts students) completion of Arts or other subjects approved by the Head of School, carrying at least 24 credit points.

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.

27.325 Urban Activity Systems S1 L2T2
27.825 Urban Activity Systems S1 L2T1

Prerequisite: 27.312/812, or (for non-majoring Arts students) completion of Arts or other subjects approved by the Head of School, carrying at least 24 credit points. 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.

27.326 Urban and Regional Development S2 L2T2
27.826 Urban and Regional Development S2 L2T1

Prerequisite: 27.312/812, or (for non-majoring Arts students) completion of Arts or other subjects approved by the Head of School, carrying at least 24 credit points. Excluded: 27.836.

Theories of urban and regional change leading to assessment of the role of planning. Emphasis on resource allocation, conflict resolution jand evaluation techniques including cost-benefit analysis and environmental impact assessment. *Lectures* accompanied by seminars and workshop sessions which concentrate on methodology.

27.327 Environment and Behaviour S1 L2T2
27.827 Environment and Behaviour S1 L2T1

Prerequisite: 27.312/812, or (for non-majoring Arts students) completion of Arts or other subjects approved by the Head of School, carrying at least 24 credit points. 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.

27.834 Spatial Population Analysis (Advanced) S2 L3T2

Prerequisites: Graded passes in 27.312/812, 27.2813. Excluded: 27.324/824.

Additional and more advanced work relating to the content of 27.324/824 Spatial Population Analysis.

27.835 Urban Activity Systems (Advanced) S1 L3T2

Prerequisites: Graded passes in 27.312/812, 27.2813. Excluded: 27.325/825.

Additional and more advanced work relating to the content of 27.325/825 Urban Activity Systems.

27.836 Urban and Regional Development (Advanced) S2 L3T2

Prerequisites: Graded passes in 27.312/812, 27.2813. Excluded: 27.326/826.

Additional and more advanced work relating to the content of 27.326/826 Urban and Regional Development.

27.837 Environment and Behaviour (Advanced) S1 L3T2

Prerequisites: Graded passes in 27.312/812, 27.2813. Excluded: 27.327/827.

Additional and more advanced work relating to the content of 27.327/827 Environment and Behaviour.

27.860 Landform Studies S1 L2T2½

Prerequisite: 27.301/801 or 27.111. Co-requisite: 27.311/811. Excluded: 27.183, 27.870.

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 S2 L2T2½

Prerequisite: 27.111 or 27.311/811 or 27.312/812. Excluded: 27.872.

Not offered in 1984.

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.

27.363 Ecosystems and Man S2 L2T2½
27.863 Ecosystems and Man S2 L2T2

Prerequisite: 27.111 or 27.311/811 or 27.312/812. Excluded: 27.873.

The structure and functioning of ecosystems, man's interaction with ecosystems; Australian case studies of ecosystem management, including pastoral, cropping, forestry, coastal and urban ecosystems.

27.870 Landform Studies (Advanced) S1 L3T3

Prerequisites: Graded passes in 27.111 or 27.311/811, 27.2813. Excluded: 27.860.

As for 27.860 Landform Studies with additional and more advanced work, including selected studies of geomorphic processes and of man's influence on those proceses.

27.872 Australian Environment and Natural Resources (Advanced) S2 L3T3

Prerequisites: Graded passes in 27.111 or 27.311/811 or 27.312/812. Excluded: 27.862.

Not offered in 1984.

As for 27.862 Australian Environment and Natural Resources, with additional and more advanced work.

27.873 Ecosystems and Man (Advanced) S2 L3T2

Prerequisites: Graded passes in 27.111CR or 27.311/811CR or 27.2813CR. Excluded: 27.363/863.

Offered subject to availability of staff.

As for 27.363/863 Ecosystems and Man, with additional and more advanced work.

27.880 Advanced Geographic Methods F L1T2

Prerequisites: Graded passes in 27.111 or 27.311/811 or 27.312/812 and 27.2813.

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.

27.890 Thesis and Associated Seminars F T3

Prerequisites: Graded passes in 3 nine-credit-point subjects in Geography. Co-requisite: 27.893 or 27.894 or 27.895.

Honours students in their final year are required to prepare a thesis of not more than 20,000 words and to attend a series of seminars on their thesis and supporting topics. The thesis topic must be approved by the Head of the School during the second half of the year *preceding* entry into the final year, while the thesis must be submitted before the examination period in November of the final year. It is expected that research work for the thesis is undertaken during the summer vacation preceding the final year.

27.893 Honours Physical Geography S1 L3T3

Prerequisites: Graded passes in 3 nine-credit-point subjects in Geography. Co-requisite: 27.890.

Advanced studies in a branch of physical geography appropriate to the area of research chosen for the thesis.

27.894 Honours Urban Geography S1 L2T4

Prerequisites: Graded passes in 3 nine-credit-point subjects in Geography. Co-requisite: 27.890.

Offered subject to the availability of staff. Check with School Office.

The study of the urban environment and the changing nature of urban geography. The impact of quantification and problems of theory building are stressed. Concern is with the individual in increasingly complex urban and regional environments. Problems and issues discussed are viewed from a policy perspective.

27.895 Honours Social Geography S1 L2T4

Prerequisites: Graded passes in 3 nine-credit-point subjects in Geography. Co-requisite: 27.890.

Offered subject to the availability of staff. Check with School Office.

Changing views of social geography in the twentieth century. The decline and resurrection of humanistic perspectives in geography. The impact of quantification and problems of theory building are stressed. The above themes are developed through consideration of such substantive areas as population-resource relationships; urbanism; social problems and social change; urban and rural relationships.

Graduate Study

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; multi-temporal monitoring and inventory of rangelands, croplands and forests; rural and urban land use assessment; surveillance of surface water resources and sedimentation; appraisal of changes in the coastal zone. Use of remote sensing in environmental management and in environmental impact assessment.

27.171G Directed Problems in Remote Sensing S2 L1½T1½C3

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 L2T1C3

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-7, 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 C2

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.

27.672G Geographic Information Systems C2

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.

27.901G Geomorphology for Hydrologists S2 L1½T1½ C3

Offered subject to availability of staff.

Geomorphological controls in the development of drainage systems. Geomorphology of drainage basins and channel networks. Forms of river channels. River floodplains and terraces. Drainage basins and networks as geomorphological systems. Geomorphology in predictive modelling of basin hydrological response and in the assessment of water resources. Geomorphology of representative basins. Short-term and long-term geomorphic changes. Air photo and map analysis of drainage basins and networks. Field study of fluvial landforms and drainage basins and networks.

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 steam velocity characteristics, tidal estuaries, ocean currents. Dispersal of pollutants in flowing water.

27.904G Geomorphology for Engineering Geologists **S2 L1½T1½ C3**

Offered subject to availability of staff.

Landform expression of lithology and structure. Hillslope forms and processes. Climate, erosion and landforms. Landform evolution and systems theory. Geomorphology and soil erosion. Geomorphological background to coastal engineering problems. Forms of rivers and alluvial floodplains. Geomorphological approach to terrain evaluation. Exercises in the analysis and systematic description of terrain types from maps and airphotos. Field excursion on terrain assessment.

27.910G Geomorphology of Arid Lands **S1 or 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 or S2 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 or S2 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.

27.915G Project in Land Evaluation **S2 T9 C9**

Practical application of a system of land classification in an arid or semi-arid environment as a basis for land management or land-use planning, or a comparative review of existing approaches to land evaluation. Involves fieldwork, probably at Fowlers Gap Research Station, and the preparation of a report. *Tutorial hours* are equivalent contact hours, but also involve fieldwork out of session.

27.916G Research Project in Land Evaluation **F T9 C9**

As for 27.915G Project in Land Evaluation, but involving more substantial research over a longer period. *Tutorial hours* are equivalent contact hours, but also involve fieldwork out of session.

27.917G Project in Soil Conservation **S2 T9 C9**

A practical investigation of soil degradation associated with the deterioration of rangeland on Fowlers Gap Research Station, or in another part of arid or semi-arid Australia, in relation to soil-vegetation characteristics and land use. May involve investigation of techniques used in combatting soil erosion problems. Involves the preparation of a report. *Tutorial hours* are equivalent contact hours, but also involve fieldwork out of session.

27.918G Research Project in Soil Conservation **F T9 C9**

As for 27.917G Project in Soil Conservation, but involving more substantial research over a longer period. *Tutorial hours* are equivalent contact hours, but also involve fieldwork out of session.

Marketing

Undergraduate Study

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.

28.032 Behavioural Science — S1 L2T2

Prerequisite: Nil.

Major concepts and research in the behavioural sciences which reveal the dynamics of human behaviour and the variety of viewpoints that can be adopted in explaining behaviour. Nature and scope of behavioural science; culture; social institutions; groups; social class; interpersonal and mass media communication; learning; perception; personality. Prerequisite for 28.042 Consumer Behaviour.

28.042 Consumer Behaviour — S2 L2T2

Prerequisite: 28.032.

Specific sociological and psychological topics in Behavioural Science applied to the problem of understanding the consumer in the marketing context. Motivation and arousal; consumer behaviour as a decision process; problem recognition; search behaviour; choice behaviour; purchasing processes; post-purchase behaviour.

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

Undergraduate Study

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.

Graduate Study

29.520G Photogrammetric Production Processes — SS L1½T1½ C3

Automation. Orthophotography. Physical aspects of photography. Photogrammetric planning, applications of photogrammetry. Digital terrain models.

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.

29.604G 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. Computerisation of land information. Data input methods. Data storage methods. Data processing and manipulation, including management, searching, existing data base languages, and interactive data editing. Data output, including computer graphics, line printer maps, and digital plotters.

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.

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.

Graduate Study

30.935G Organization Behaviour A **S1 L3**

Organizations are examined as open systems exhibiting a variety of structural patterns within an external, economic, social, political and technological environment which is uncertain and rapidly changing. Against this background the subject lays the foundations for gaining insight into human behaviour in organizations.

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 — the meanings, the rules, the procedures — 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 newtork as well as the *uses* made of those messages by network participants for the overall attainment of organizational goals.

30.960G Technology and Organizations **S1 L3**

Prerequisite: 30.935G or other approved subject.

The complex relationships between technological change and organizations, workforces and skills in societies using advanced technology such as, Australia, California, Japan, Germany and Scandinavia. Students carry out projects analyzing the relationship between technological change and organizational variables; such as control and power; employment and skill formation in an industry, organization or group (eg engineers, women, immigrants); working environment, socio-technical systems, quality of working life, occupational health and safety, recurrent education, new patterns of work, industrial relations and industrial democracy.

Town Planning

Undergraduate Study

Core Subjects

36.3112 Environmental Psychology **2CCH**

The environment considered subjectively and objectively. Man as a social and psychological rather than a strictly economic being. The significance for decision-making, of individual and group values held on the environment (nature and man-made), from individual decision on where to live through to government decisions on policy. Forces influencing the formation of these values. The distinction between values held and actual behaviour. The emergence of different viewpoints and resultant conflicts. The role of planning in understanding, anticipating and reconciling such conflicts.

36.411 Town Planning **S1 L2T1**

Architecture prerequisite: 11.4309.

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.

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.

Landscape Architecture

Undergraduate Study

Students should contact the Head of School before enrolling in any of the following subjects.

37.3015 Environment Impact Assessment I **S1 L1T1**

2 credit points. Prerequisite: 156 credit points, or as otherwise approved by Subject Authority.

Not offered in 1984.

37.3016 Environmental Impact Assessment II **S2 L1T1**

2 credit points. Prerequisite: 37.3015.

Not offered in 1984.
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.

37.5816 Land Systems **S2 L2T1**

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.

37.5817 Land Management **S1 L1T1**

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.

37.7145 Landscape Planning I **S1 L2T2**

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.

37.7146 Landscape Planning II **S2 L2T2**

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.

School of Food Technology

Undergraduate Study

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. Principles of food preservation.

38.131 Principles of Food Preservation **S1 L4**

Prerequisites: 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, ionising 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. Water quality criteria, treatment of water. Nutritional consequences of food processing.

38.132 Plant Food Science **S1 L3**

Prerequisites: 2.002A, 2.002B, 2.002D, 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: 2.002A, 2.002B, 2.002D, 38.122, 38.521.

Meat: animal resources, breeds, growth and development. Slaughter, carcase composition, post-mortem biochemistry, meat composition, structure and quality factors, meat microbiology. Cold storage, chilling, freezing, ageing, curing, drying and packaging of meat and meat products; their microbiological and biochemical implications.

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: general composition, proteins, lipids, carbohydrates, vitamins, minerals, flavour, colour; milk contaminants: antibiotics, pesticides, radionucleotides, sanitizer residues; milk microbiology: spoilage, public health, pasteurization; chemistry, biochemistry, microbiology and manufacture of milk products: homogenized, dried and condensed milks, cream, butter, ice cream, cheese, yoghurt.

38.134 Food Science Laboratory — T6

Prerequisites: 2.002A, 2.002B, 2.002D, 41.101. Co-requisites: 38.131, 38.132, 38.133, 38.331, 38.431.

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-requisites: 10.301, 38.134.

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 — T8

Prerequisite: 38.134. Pre- or co-requisites: 38.131, 38.132, 38.133.

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 NH&MRC 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

Prerequisite: 38.131.

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.

38.331 Food Microbiology I — S1 L3

Prerequisite: 44.143 or other equivalent introductory Microbiology subject.

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 II — 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 — S2 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 I — S2 L2T1

Raw materials, markets, organisation 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.

38.431 Food Engineering II — 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 III — S1 L4T2

Prerequisites: 38.421, 38.431.

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 Introductory Biochemistry.

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 — S1 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.

Graduate Study

38.151G Introductory Food Science — S1 L1 S2 T1

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

38.152G Food Process Laboratory — S2 T4

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 — 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

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 — L1

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 — L1

Prerequisite: 38.133 or 38.166G.

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

38.161G Food Additives and Toxicology — S1 L2

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

38.162G Postharvest Physiology and Handling of Fruit and Vegetables — S2 L2T4

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

38.163G Methods in Food and Nutrition Education — S1 L1T2

Co-requisite: 38.553G.

Community food and nutrition habits, knowledge and beliefs. Programs for nutrition education; design and evaluation. Communication and educational skills including use of instructional media and preparation of audiovisual materials.

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. Water quality criteria for food processing.

38.165G Plant Food Products — S1 L3T1

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, texturising, processing; nutritional and toxicological considerations.

38.166G Animal Food Products — S2 L2T1

Meat: animal distribution, breeds; slaughter, pre- and post-mortem handling; meat composition, structure, microbiology, quality; preservation by chilling, freezing, curing, drying, packaging; meat by-products. *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:* milk composition, physical properties, microbiology, conversion to other dairy products; contaminants, sanitisers; chemistry and biochemistry of cream, butter, cheese, ice-cream, yoghurt; dried, condensed and homogenised products.

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; sublethal 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 38.431 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-requisite: 38.551G.

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

The role of the nutrients in human structure and function, including nutritional imbalance states. Includes simple anthropometry and dietary intake study.

38.601G Food Technology A — S2 L3

The principles of nutrition, digestion and absorption with reference to carbohydrates, fats, proteins and amino acids; mineral substances; calcium, phosphorus, iron, iodine and fluorine; vitamins A, C, D, E, K, the B-group vitamins; foodstuffs and nutrition; nutritional problems of SE Asia; an introduction to the chemistry and structure of carbohydrates, fats, proteins and amino acids, vitamins; enzymology of foods.

38.602G Technology of Food Preservation A — S1 L2T1

Brief history and principles of food preservation; current status of food preservation in developing countries with emphasis on the use of salt, sugar, acids and other chemical preservatives; effect of water activity on chemical and microbial stability of foods; intermediate moisture foods; preservation by heat, chilling and freezing, spoilage mechanisms; effects of processing on nutritional quality and functional status; prospects for food irradiation.

38.603G Food Engineering A **S2 L3**

An introduction to food engineering concepts; foods of developing and developed countries; world trade in food and agriculture; international food organisations; food hygiene and public health; standards for foods; parameters of food quality; food choice and social behaviour.

38.604G Food Engineering B **S2 L3**

Thermal and physical data for foods; food processing equipment; rheology of foods; non-Newtonian fluid flow; specification of equipment for the processing of fluid foods.

38.605G Food Technology B **S1 L2T1**

Microorganisms associated with foods; factors affecting microbial growth and survival; enumeration of microorganisms in foods; ecology of microbial food spoilage; food-borne microbial disease; food hygiene; microorganisms and fermented food products; simple laboratory procedures for the microbial and chemical analysis of foods.

38.606G Technology of Food Preservation B **S1 L3**

Drying of foods; psychrometry; batch and continuous drying; drying of grain in storage silos; solar drying, sun drying of foods; spray, spouted bed, fluidized bed drying; nature and control of postharvest losses of cereal grains, grain legumes, tubers, fruit, vegetables, the role and use of packaging materials, container function and construction; storage life assessment of packaged foods.

38.607G Technology of Food Processing A **S1 L2T1**

The science and technology of meat, marine, poultry and milk products; livestock and fishery resources; meat structure, composition, postmortem changes; meat microbiology; ambient storage and distribution, cold storage, chilling and freezing processes; meat drying, salting, curing and smoking; milk composition, properties, microbiology, pasteurisation processes, milk products; egg structure, composition, quality, defects; preservation of shell eggs, liquid egg products and uses; fish handling, spoilage and preservation; fish meals and protein concentrates; emphasis on upgrading of traditional products and procedures.

38.608G Food Engineering C **S1 L3**

Non-Newtonian heat transfer; specification of heat transfer equipment for food processing; materials of construction for food processing equipment; principles of liquid food evaporation; vapour compression and absorption refrigeration; liquid-liquid and liquid-solid extraction; transient heat transfer; measurement and control of process variables; economic decision-making.

38.609G Technology of Food Processing B **S2 L3**

The science and technology of plant-derived foods; cereals, legumes, tubers, spices, fruit, vegetables and sugars; composition of cereal grains; processing, storage of traditional products; processing of legume products, fruit, vegetables, tubers; sources, composition, processing of fats and oils, functional properties and use with other foods; deteriorative changes; sugar processing from beet and cane; refining processes.

38.610G Food Engineering D **S2 L3**

The transport phenomena approach to heat transfer, mass transfer and fluid flow in continuous and discontinuous phases; numerical methods of solution; use of computer packages for statistical and other calculations; thermodynamic analysis of processes in both simple and complex food processing operations.

38.611G Food Engineering Laboratory **S2 L3**

Laboratory and pilot plant exercises illustrating the principles and procedures involved in food processing and food quality assessment. Where applicable, emphasis on middle-level technology and nature of indigenous foods.

38.612G Food Engineering Field Work **S2 L3**

Inspection of food processing factories, agricultural and food research stations and the major food and grain producing areas in Queensland, New South Wales, Victoria and South Australia.

38.900G Master of Applied Science Major Project **T6**

38.901G Master of Applied Science Minor Project **T3**

38.902G Reading Assignment **S2 T3**

Special reading assignments are set and examined by the School of Food Technology.

Graduate School of the Built Environment

Graduate Study

39.908G Community Noise Control **S1 L1T1C2**

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.

Biochemistry

Undergraduate Study

41.101 Biochemistry — S1 L4T8

Prerequisites: 17.041, and 2.121 & 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 molecular mechanism of gene expression and protein synthesis. Photosynthesis. *Practical work* to amplify the lectures.

41.111 Biochemical Control — S2 L2T4

Prerequisite: 41.101.

The relationship between structure and function of enzymes, selected protein systems and hormones. Metabolic networks and control mechanisms. *Practical work* to amplify the lectures.

41.102A Biochemistry of Macromolecules — S1 L3T9

Prerequisites: 41.101 or 41.111 (students must obtain a clear pass (PS) in either of these subjects), 2.002B.

Polysaccharides and glycoproteins including bacterial cell walls. Chemistry and biology of polynucleotides. Methods of amino acid and nucleic acid sequence analysis. Protein structure and synthesis. Active centres of some proteins. Sub-unit organization of proteins. Enzyme kinetics. *Practical work* to illustrate the lectures and to provide experience in modern biochemical techniques.

41.102B Physiological Biochemistry — S2 L3T9

Prerequisites: 41.101 or 41.111 (students must obtain a clear pass (PS) in either of these subjects), 2.002B

Electron transport and oxidative phosphorylation. Mitochondrial transport and function. Interrelationships in mammalian intermediary metabolism. Biochemical control mechanisms including hormones and allosteric interactions. Biochemistry of genetic diseases. Selected aspects of differentiation and development in higher organisms. *Practical work* to illustrate the lectures and to provide experience in modern biochemical techniques.

41.102C Plant Biochemistry — S2 L2T4

Prerequisites: 41.101 or 41.111 (students must obtain a clear pass (PS) in either of these subjects), 2.002B.

The biochemistry of the major pathways characteristic of plants will be studied; topics include the energetics and carbon path of photosynthesis, glyoxalate cycle, growth hormones and regulatory phenomena, nitrogen fixation and assimilation. *Experimental work* to illustrate and amplify the lectures utilizes radioactive isotopes and a number of newer techniques.

Biotechnology

Undergraduate Study

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.

Graduate Study

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 anapierotic processes, with emphasis on hydrolysis and synthesis of polymers, glycolysis and gluconeogenesis of glucose, β-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.

Botany

Undergraduate Study

43.101 Introductory Genetics — S2 L2T4

Prerequisites: 17.031 and 17.041 (see Note).

Note: Students with percentile range 61-100 in HSC Examination 4 unit Science with Biology, or 2 unit Biology may apply to enrol in 43.101, 45.201 or 45.301 in lieu of 17.041 after completion of 17.031. Students are selected by the Head of School for enrolment in these units. If successful, students will have met the prerequisite requirement of 17.041 Biology B for all units.

Students should consult lecturers before purchasing textbooks.

Various aspects of molecular, organismal and population genetics, including: mechanisms of recombination and mapping in higher organisms; recombination and mapping in microorganisms; mutagens, structural and gene mutations, molecular structure of the gene, biochemical genetics, control of gene expression, genetic interaction, gene pools and gene frequencies, genetics and disease, genetic engineering.

43.111 Flowering Plants — S1 L2T4

Prerequisites: 17.031 & 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 weekend field excursion is part of the subject.

43.112 Taxonomy and Systematics — S2 L2T4

Prerequisite: 43.111. Co-requisite: 43.101.

This unit alternates each year with 43.162 The Plant Kingdom. 43.112 is given in 1984. If both units are to be included in three-year pass degree program, one should be completed in Year 2.

This unit may be taken in either Year 2 or Year 3 of the Science and Mathematics Course provided that prerequisites have been completed.

The assessment, analysis and presentation of data for classifying organisms both at the specific and supra-specific level.

43.122 Plant Physiology — S2 L2T4

Prerequisites: 17.041, 12.031, 2.121 and 2.131, or 2.141.

This unit may be taken in either Year 2 or Year 3 of the Science and Mathematics Course provided that prerequisites have been completed.

The study of how plants work at all levels from the cell to the whole plant. Includes: photosynthesis, respiration, transport, inorganic nutrition, plant growth substances, germination, growth, development, and flowering. Important practical applications of plant physiology are also considered.

43.142 Environmental Botany — S1 L2T4

Prerequisites: 17.031 & 17.041.

This unit may be taken in either Year 2 or Year 3 of the Science and Mathematics Course provided that prerequisites have been completed.

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. Students are required to attend one week-day field excursion as part of the practical course.

43.152 Plant Community Ecology — S2 L2T4

Prerequisites: 43.111 and 17.041 or 27.111.

This unit may be taken in either Year 2 or Year 3 of the Science and Mathematics Course provided that prerequisites have been completed.

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 an integral part of this course.

43.162 The Plant Kingdom S2 L2T4

Prerequisite: 43.111.

This unit alternates each year with 43.112 Taxonomy and Systematics. 43.112 is given in 1984. If both units are to be included in three-year pass degree program, one should be completed in Year 2.

This unit may be taken in either Year 2 or Year 3 of the Science and Mathematics Course provided that prerequisites have been completed.

The major taxa of the Plant Kingdom with emphasis on the green plants. The evolution of basic vegetative structures, reproductive structures and genetic systems are studied. Field work part of the course.

43.172 Phycology and Marine Botany S2 L2T4

Prerequisite: 43.111.

This unit may be taken in either Year 2 or Year 3 of the Science and Mathematics Course provided that prerequisites have been completed.

The biology of freshwater, marine and soil algae with particular emphasis on the marine flora of SE Australia. Field work is part of the course.

44.143 Microbiology AS S1 L4T6

Prerequisites: 17.031 and 17.041.

The history, general nature, occurrence and importance of microorganisms. General features of procaryotic and eucaryotic protista. Basic microbiological methodology; bacterial anatomy and cytology; cell walls, flagella pili, nucleus, inclusions, capsules, endospores. Microbial growth; methods of measuring; growth curves; batch, continuous and synchronous cultures. Microbial nutrition and metabolism; autotrophs and heterotrophs; photosynthesis, fermentation and respiration; biosynthesis. Bacterial genetics: adaptation, mutation and mutagens; conjugation; plasmids and drug resistance factors; genetic engineering concepts. Bacterial virology; lytic phages, lysogeny, transduction, phage typing. Bacterial taxonomy, ecology and diversity, basic principles and review of the major bacterial genera and groups. Yeasts and fungi; general ecology, morphology and modes of reproduction; mycotoxins. Immunology and serology: antigens, antibodies and their interactions; applications to identification. Medical microbiology; microbes as pathogens. Applied microbiology. Microbiology of soils and waters, nitrogen fixation, industrial fermentations, alcoholic beverages, single cell protein, food microbiology.

For further information regarding the following subject see the Faculty of Medicine Handbook.

Microbiology

Undergraduate Study

44.101 Introductory Microbiology S1 L2T4

Prerequisites: 17.031 & 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.

Students wishing to enrol in this subject must obtain the written approval of the Head of the School of Microbiology. Those who can provide evidence of previous satisfactory training in biological science will be permitted to enrol immediately. In the absence of such evidence, students will be required to attend a course of lectures in Basic Cellular Biology to be presented in the first three weeks of Session 1. This course introduces the concepts of cellular biology, cell theory and cellular diversity including structure and function of cells. It also briefly describes biologically important molecules (proteins, polyaccharides and nucleic acids), enzyme catalysis and biological dynamics.

Zoology

Undergraduate Study

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 & 10.001 or 10.011.

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 L2T4

Prerequisites: 17.031 & 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 an 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 man. Field excursions as arranged.

45.422 Economic Zoology — S1 L2T4

Prerequisite: 45.201 or 45.402.

A study of the biology, ecology and control of vertebrate and invertebrate animals which harm man and his possessions. Human and domestic animal parasitology, pests on plants, diseases caused or spread by animals, chemical, biological and physical control, and side effects.

Graduate Study

45.900G Ecological Studies in Arid Lands Management — S2 L2T4

Prerequisite: Degree with background in bioscience of 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

Graduate Study

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 Project — Maximum C20

Research investigation on an approved topic, conducted either individually or as part of a team.

46.201G Themes in Environmental Studies — C3

Lectures and seminars on a set of themes: resource use and conservation, pollution abatement, hazard perception and adjustment.

46.203G Medical Aspects

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

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

Undergraduate Study

General

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

Students of Chemical Engineering are expected to have a copy of Perry J. H. ed. *Chemical Engineers' Handbook* 5th 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 **S2 L1T1**

Introduction to the processing industry. Application of material and simple energy balances in chemical process operations. Information retrieval.

48.021 Chemical Engineering IA

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 **S1 L1T1**

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 IB

Prerequisite: 48.021.

Unit 1 Heat Transfer I **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 Computations I **S1 T1 S2 T1**

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**

Prerequisite: 48.021.

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 48.021 and Units 1 and 3 of 48.022.

48.031 Chemcial Engineering IIA

Unit 1 Mass Transfer (Theory) **S1 L1T1**

Prerequisites: 2.002A, 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 counter-diffusion 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 II (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 I — 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 Surface Separation Processes — S2 L1

Principles of membrane processes, reverse osmosis, ultrafiltration, dialysis and electrodialysis. Design calculations for batch and continuous operation of reverse osmosis and ltrafiltration 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.

Unit 6 Economics I — 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, optimisation. Depreciation and taxation and their effect on economic analyses. Economic design.

48.032 Chemical Engineering IIB

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 Computations II — S2 L1T1

Prerequisites: 10.031, 48.022 Unit 2.

Digital Computation: Introduction to Cyber control language, use of files, efficient FORTRAN programming methods. Numerical methods for solving algebraic equations, and other computer techniques. Application to the analysis and solution of selected chemical engineering problems. *Analogue Computation:* An introduction to the theory and programming of analogue and computers, with application to the solution of differential equation and the simulation of dynamic systems.

Unit 3 Engineering Thermodynamics — S2 L1

Prerequisite: 48.135.

Engineering applications of thermodynamics. Heat engines, refrigeration.

Unit 4 Economics II — 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 Safety and Failure Tolerance — S2 L1

Prerequisite: 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.

48.033 Chemical Engineering IIC

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 II (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: 8.112.

Mechanical design and fabrication of pressure vessels. Code and legal requirements. Design of supports for vertical and horizontal cylindrical vessels. Visualisation, 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 I **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 I

Unit 1 and 2 **S1 T2 S2 T2**

Prerequisites: 48.021, 48.022, 2.002A.

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 IA & B II 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 IIJ **F L1½T1½**

Structure of the Australian chemical and mineral utilization industries. Fundamentals of manufacturing processes for industrial chemicals, petrochemicals and utilization of minerals. Detailed factory inspections. Plant and process management. Statutory and ethical considerations. Mathematical modelling of processes for management purposes. Plant and process development. Chemical engineering in practice including case studies in the use of mass and energy balances, and thermodynamic and kinetic calculations to assess current process performance and to propose improvements.

48.040 Chemical Engineering Project **S1 T1 S2 T11 or S1 T6 S2 T6**

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 IIIA

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 & 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 IIIB

Prerequisites: 10.032, 48.163.

Unit 1 Process Dynamics and Control I **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 IIIC

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 II — S1 T3

Prerequisites: 48.031, 48.032, 48.033, 48.036, 48.135, 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.

48.047 Chemical Engineering IIID

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 II — 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 shut-down. Temporary and permanent corrections. Exercises in fault analysis and correction using cases from practice.

Unit 3 Process Dynamics and Control II — 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.

48.048 Advanced Chemical Engineering

Unit 1 Petroleum and Reservoir Engineering — F L2T1

Origin of petroleum, rock properties, fluid distribution in reservoirs, phase behaviour of hydrocarbons, material balance equations, analysis of reservoirs, gas reservoirs; gas condensate reservoirs; solution gas drive reservoirs; water drive reservoirs. Application of potential flow equations, multi-phase flow through porous media, fluid displacement, recovery efficiency, well testing. Well productivity, maximum efficient rate of withdrawal. Numerical techniques for reservoir simulation, new recovery methods. Sources. Process design applied to gas and oil treatment plants, pipelines and storage. The petroleum refinery. Products blending. Refinery economics. Optimization of refinery operations. Design and operation of refinery equipment.

Unit 2 Mineral Chemistry — F L2T1

This subject includes 4.121 Principles of Metal Extraction (F L1T1) plus a sub-unit entitled Stabilities of Inorganic Aqueous Systems containing: sources of equilibrium stability data, methods of presenting stability data for application to interpreting the chemical reactions and mechanisms of aqueous processes.

48.049 Automation and Optimization for Ceramic Engineers — S1 L2½T1½

Consists of 48.165 Laboratory Automation Science and Unit 2 — Optimization of 48.042 Chemical Engineering IIIB.

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: 2.002A. Co- or prerequisites: 2.002B, 2.042C.

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

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 — S2 L1½T4½

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 IA — S1 L2T3

Comprises 48.021 Units 1 and 2.

48.126 Industrial Chemistry IB — 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

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 I — 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 IIA — 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 IIB — S2 L2T1

Consists of Computations II, 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 I — S2 L2T1

Prerequisites: 10.031, 48.122 or 2.002D. 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 L1½T1½

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 envisiage 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 II — 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 T3

Co- or prerequisite: 48.184.

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 schools or departments in a different faculty.

For further information regarding the following subjects see the Combined Sciences Handbook.

48.023 Chemical Engineering Science I S1 L3T2 S2 L2½T2½

Prerequisites: 1.001, 10.001.

Flow of Fluids: 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. *Dimensions and Dimensional Analysis:* Units and measures. Conversions of units and equations. Dimensions and Dimensional Analysis. Basic principles of modelling. *Heat Transfer I:* 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. *Pumps and Pumping:* Types of piping and fittings. Blow cases. Air lift pumps. Reciprocating pumps, centrifugal pumps and gear pumps. Blowers and compressors. *Material Balances:* A revision and extension of material balance calculations with more complex examples, including those arising from stagewise operation of extraction equipment. Graphical solution of multi-stage calculations. *Computations I:* A review of the fundamentals of FORTRAN, with extension to formating, dimensioned variables and subroutines. Application to the solution of selected problems involving heat and mass balances, fluid flow and pumping.

48.024 Chemical Engineering Principles I S1 L2T1 S2 L1T1

Prerequisites: 1.001, 10.001.

The following topics, from 48.023: Flow of Fluids, Heat Transfer I, Dimensions.

48.037 Chemical Engineering Science II F L5T2

Prerequisites: 2.002A, 48.023.

Mass Transfer (Theory): 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. *Heat Transfer II (Theory):* An extension of the work covered in Heat Transfer I, with an emphasis on the fundamentals of convection and condensation; unsteady state conduction; introduction to heat exchanger design. *Surface Separation Processes:* 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 on exchange and molecular sieves. Design of fixed bed sorption equipment. Principles and design of the surface separation processes such as foam and bubble fractionation. *Fluid-particle Systems:* Interaction between particles and fluids; drag, terminal velocity, sedimentation. Flow through porous media; pressure gradient, filtration, fluidization, dispersion; multiphase flow, irrigated packed columns. *Reactor Engineering:* Introduction to reactor design: ideal batch, steady state mixed flow; steady state plug flow, size comparisons of ideal reactors, optimization of operating conditions. Multiple reactor systems: reactors in series and parallel, mixed flow reactors of different sizes in series, recycle reactor, autocatalytic reactions. Multiple reactions: reactor design for reactions 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:* Basic concepts: rate laws, correlation with driving force, linear and non-linear systems, lumped and distributed parameter systems. Experimental measurement and correlation of process rates. *Thermodynamics:* Review of first law of thermodynamics: thermochemistry; second law of thermodynamics. Auxiliary functions and conditions of equilibrium. Thermodynamic properties of fluids; thermodynamic properties of homogenous mixtures. Chemical reaction equilibria: calculation of equilibrium compositions for single reactions. Phase equilibria: the phase rule, equilibrium. *Computations II: Digital Computation:* Introduction to Cyber control language, use of files, efficient FORTRAN programming methods. Numerical methods for solving algebraic equations, and other computer techniques. Application to the analysis and solution of selected chemical engineering problems. *Analogue computation:* An introduction to the theory and programming of analogue computers, with application to the solution of differential equations and the simulation of dynamic systems.

48.038 Chemical Engineering Principles II S1 L3T1 S2 L1T1

Prerequisite: 48.024.

The following topics, from 48.037; Mass Transfer (Theory), Heat Transfer II (Theory), Fluid-particle Systems, Surface Separation Processes.

48.101 Computation and Modelling in Applied Chemistry

For further information regarding the following subject see the Faculty of Engineering Handbook.

48.412 Polymer Materials

Department of Biological Process Engineering

48.211 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. Co-ordination 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 I, 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 II.

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 I

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 II

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_2 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 III

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 **S1 or S2 L2T1**

Prerequisites: 2.002A, 2.002B, 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.

Graduate Study

General

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.

48.071G Corrosion Technology I

Theory of Corrosion — Principles: Thermodynamics, electrode kinetics. Applications: Predicting corrosion behaviour, corrosion prevention, corrosion rate measurements. *Industrial Corrosion:* Definitions — what it is. Terms used, units of measurement, corrosion research, corrosion technology, importance of corrosion (loss of product, downtime, safety, etc). Extent — where it occurs. Cost. Economics. How it is prevented — materials selection, coatings, design, cathodic prevention, inhibitors.

Types of Corrosion: Direct chemical, galvanic, crevice, pitting, intergranular, phase attack, erosion — cavitation, stress, fatigue, hydrogen, fretting, atmospheric oxidation, high temperature oxidation. *Materials — non-metallic:* Plastics: thermoplastic — cellulose, acrylics, nylons, polyethylenes, vinyls, polypropylene, polystyrenes, fluorocarbons, chlorinated polyether. Thermosetting — phenolics, epoxies, polyesters, silicones, ureas, laminates. Laminates: reinforced plastics — fibreglass. Foamed Plastics. Rubbers: natural, synthetic — butyl, buna-S, neoprene, nitrile, ABS, silicone. Glasses: bulk — borosilicate, fused silica, glass linings. *Ceramics:* acid resisting bricks, stoneware, porcelain, concrete. *Carbon and graphite. Woods.*

Principles of Design for Corrosion Prevention. Environmental Factors: Galvanic effects — potential differences, concentration cells, anode/cathode/areas operating anodic and cathodic reactions polarization, passivity ionic conducting electrolyte. Oxygen, velocity, temperature, atmospheric contaminants, partial immersion, geometry of design, fabrication and erection. *Intrinsic Factors:* material structure, heat treatment, surface finish. *Corrosion Testing:* aims, specimens, surface preparation, measurements, exposure techniques, duration, aeration, temperature, expression of results — units, interpretation of results, standard tests.

48.072G Corrosion Laboratory

Laboratory assignments to illustrate and measure the mechanism of corrosion. Electroplating/anodising experiments.

48.073G Corrosion Materials

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, chrominium, cobalt. Refractory metals — molybdenum, tantalum, tungsten, zirconium. Noble metals — gold, platinum, silver.

48.074G Corrosion Technology II

Corrosion in: *Special equipment and structures,* piping, tanks, heat exchangers. *Special Environments* — corrosion by sea water, soils, fresh water, steam, atmosphere, lubricants and packings, mineral acids, organic acids, alkalis, petroleum industry, biological means, liquid metals. *Surface Preparation and Coatings:* General Theory — surface preparation — acid cleaners, alkali cleaners, solvent cleaners, mechanical cleaning, equipment. Coatings — types, properties and applications, pre-treatments, primers based on acrylics, alkyd, bitumen, epoxy, chlorinated rubber, metals, phenolic polyurethane, vinyls. Temporary corrosion — preventive. Heat resistant, electroplated metal sprayed. Wrappings.

48.075G Corrosion Seminar

Joint University/Industry colloquia on theory and practice of corrosion technology. Students present material arising from literature and/or laboratory assignments and industrialists are invited to contribute papers and/or participate in the colloquia.

48.076G Corrosion Literature Review

Students are expected to consult and read the wide literature on corrosion and to produce a comprehensive and detailed report on a selected topic, eg aspects of corrosion in the acid industry; marine corrosion; corrosion problems in the food industry; underground corrosion of pipelines.

48.077G Testing Laboratory

Candidates undertake a project involving the design/evaluation of corrosion testing equipment/techniques. A comprehensive report is submitted.

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.

48.083G 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, temperaure/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.

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 hono- and heterogeneously sized particles. Co-current systems. Limiting particle transport velocity. Instabilities, various criteria. Transport line feed systems, transport line driers and reactor. Design of co-current fluid-particle systems. Gas-fluidized beds. Gross behaviour, bubblephase theories, instability theories, grid-bed geometry and resistance relationships, elutriation, residence-time and size-distribution studies. Heat and mass transfer: design of catalytic and non-catalytic fluidized reactors.

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.

48.131G 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 quality 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.

Department of Biological Process Engineering

General

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

48.281G 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 could 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 micro-organisms; batch, semi-batch and continuous reactors; gas exchange balances. Rate processes in microbial flocs and microbial films. Design for microbial floc and film reactors.

48.282G Microbial Kinetics and Energetics

Unit 1 Microbial Kinetics

Prerequisite or co-requisite: 48.281G 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: 48.281G 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.

48.283G 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.

48.284G Heat, Mass and Momentum Transport

A bridging subject designed to provide an introductory understanding of the mechanisms of transport processes. This subject could 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.

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. Legal aspects: case histories.

48.387G Fuel Technology Practice

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

48.391G Atmospheric Pollution and Control (Theory) S1 or S2 L3

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

48.329G Atmospheric Pollution and Control (Political Aspects) S1 or S2 T3

Prerequisite: 48.391G.

Laboratory and tutorial programs in the measurement and analysis of ambient and industrial air pollutants. Computational tutorials in advanced dispersion models, aerosol dynamics and control equipment design parameters.

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, antioxidants, 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.

Sociology

Undergraduate Study

53.001 Introduction to Sociology F L2T1

An introduction to major issues in Sociology. There are two main themes: culture, society and institutions; and social inequality. Topics: social control, power, sexism, work and leisure, class distinctions. These are treated both factually and theoretically and are considered as they relate to the situation in Australia and in the developing countries.

Assessment: On the basis of performance in essays, written assignments, and tutorial classes.

Political Science

Undergraduate Study

54.1002 Power and Democracy in Australia — S1 3CCH

Excluded: 54.1001 and 54.1003.

Who has power in Australia? The formal political institutions (parliament, government, elections, the political parties) and also the trade unions, the media, business, pressure groups and the bureaucracy as sources of political power. The capitalist nature of Australian society and ideas about democracy, freedom and equality in Australia and at the structure of Australian society. Sources of inequality such as education, sex, law and race.

54.1003 Australian Political Institutions — S1 and S2* 3CCH

Excluded: 54.1001 and 54.1002.

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

Excluded: 54.1001.

An examination of 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 both 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 — S1 and S2** 3CCH

Excluded: 54.1001.

An introduction to the history of Western political thought from the Renaissance to modern times. Six texts form the basis of this subject: Machiavelli's *The Prince*, Hobbes' *Leviathan*, Locke's *Second Treatise of Government*, Rousseau's *Social Contract*, Mill's *On Liberty* and selected writings from Marx.

*S1 has evening lectures. Repeated in S2 during the day.

**S1 has daytime lectures. Repeated in S2 during evenings.

54.2008 Public Policy Making — S2 3CCH

Prerequisite: 54.1001 (or equivalent) or 12 credit points from Political Science Level I subjects including 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 povery and education.

Australian Graduate School of Management

Graduate Study

85.716G Public Policy

The processes by which public policies evolve and their outcomes in society. The role of the policy analyst in conceptualizing problems and developing strategies. Topics include: techniques of analysing the decision-making process; specific methods of policy analysis; the relevance of political skill and bargaining in determining outcomes; and problems of policy implementation.

85.721G Economics of Natural Resources

Half unit. Prerequisite: 85.131G or its equivalent.

An examination of the stock and flow conditions necessary for the efficient allocation of natural resources (including environmental amentities) through time. Application to actual resource markets to examine relative scarcity and price fluctuations. Policies for resource management.

Financial Assistance to Students

The scholarships and prizes listed below are available to students whose courses are listed in this handbook. Each faculty handbook contains in its **Financial Assistance to Students** section the scholarships and prizes available within that faculty. The **General Information** section of the Calendar contains a comprehensive list of scholarships and prizes offered throughout the University.

Scholarships

Undergraduate Scholarships

As well as the assistance mentioned, there are a number of scholarships available to students. What follows is an outline only. 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*	$180 pa	Minimum period of approved degree/ combined degree course	Merit in HSC and total family income not exceeding $6000
Sam Cracknell Memorial	Up to $3000 pa payable in fortnightly instalments	1 year	Prior completion of at least 2 years of a degree or diploma course and enrolment in a full-time course during the year of application; academic merit; participation in sport both directly and administratively; and financial need
Girls Realm Guild	Up to $1500 pa	1 year renewable for the duration of the course subject to satisfactory progress and continued demonstration of need	Available only to female students under 35 years of age enrolling in any year of a full-time undergraduate course on the basis of academic merit and financial need

*Apply to The Secretary, Bursary Endowment Board, PO Box 460, North Sydney 2060 immediately after sitting for HSC.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
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 or members of the family of such members.
Ceramic Engineering			
Australian Ceramic Society	Up to $600 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		
Monier Limited	Up to $1000 pa		
North Sydney Brick and Tile Co Ltd	Up to $1000 pa		
The Brick Manufacturers' Association of New South Wales	Up to $900 pa		
The State Brickworks	Up to $900 pa		
The Thomson Family	Up to $1000 pa		
Wunderlich Limited	Up to $1000 pa		
Zacuba Pty Ltd	Up to $750 pa		
Ferro Corporation	Up to $600 pa		
Plessey Australia Pty Ltd	Up to $1000 pa		
Fowlerware	Up to $500 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to Year 2 of the full-time degree course in Ceramic Engineering
Chemical Engineering and Industrial Chemistry			
Shell Refining (Australia) Pty Ltd	Up to $800 pa	1 year renewable for the duration of the course subject to satisfactory progress	Eligibility for admission to Year 2 of the full-time degree course in Chemical Engineering
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
Australian Waste Disposal Conference Committee	Up to $300 pa		Permanent residence in Australia and eligibility for admission to any year of the full-time degree course in Chemical Engineering (with Fuel Engineering electives)
ICI Australia Operations Ltd	Up to $1000 pa		Permanent residence in Australia and eligibility for admission to Year 4 of the full-time degree course in Chemical Engineering

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Food Technology			
Coca-Cola Export Corporation	Up to $1000 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.
Fielder Gillespie-White Wings	Up to $1000 pa		
Food Technology Association	Up to $1000 pa		
George Weston Foods Ltd	Up to $4000 over 4 years		
Fuel Engineering			
Australian Waste Disposal Conference Committee	Up to $300 pa	1 year with possibility of further extension subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to any year of the full-time degree course in Chemical Engineering (with Fuel Engineering electives)
Metallurgy			
LNC Industrial Products Pty Ltd	Up to $1000 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to Year 1 or Year 2 of the full-time degree course in Metallurgy or Metallurgical Process Engineering Eligibility for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Process Engineering
Sandvik Australia Pty Ltd	Up to $1250 pa		
Sir Rupert Myers	Up to $1500 pa		
School of Metallurgy	Up to $1000 pa		
Mining Engineering			
Stan Sawyer Memorial Scholarship to Coal Mining Students	Up to $200 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Eligibility for admission to Year 3 or Year 4 of the full-time degree course in Mining Engineering

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Textile Technology			
Bonds Industries Ltd Bradmill Industries Ltd	Up to $1600 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
Bruck (Australia) Limited	$3100 *or* $2010 pa		
Fibremakers Division of ICI Australia Operations Pty Ltd	$2750 *or* $1850 pa		
National Council of Wool Selling Brokers of Australia	Up to $1500 pa		
Private Treaty Wool Merchants	Up to $1500 pa		
Reckitt's Toiletries International	Up to $1500 pa		
Textile Council of Australia	$3100 *or* $2010 pa		
Wool and Pastoral Sciences			
National Australia Bank	Up to $1000 pa	1 year renewable for the duration of the course, subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to the full-time degree course in Wool and Pastoral Sciences
Merck, Sharp and Dohme	Up to $1000 pa		
National Council of Wool Selling Brokers of Australia	Up to $2500 pa		

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.

*Available for reference in the University Library.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General			
University of New South Wales Postgraduate Scholarships	Living allowance of $5750 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	Living allowance of $6850 pa.		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	Other allowances may also be paid.	1-2 years; minimum duration of course	Preference is given to applicants with employment experience. Applicants must be graduates or scholars who will graduate in current academic year, and who have not previously held a Commonwealth Postgraduate Award. 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.
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 of the Year	$16000 over 2 years for further studies in USA, UK, Northern Europe or in special cases Australia. There are no special allowances for travel or accommodation for married graduates.	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 30 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 Commonwealth citizens or British Protected Persons, and who are not older than 35 years of age. Applications close with Registrar by 15 September.
Sam Cracknell Memorial	Up to $3000 pa		See above under **Undergraduate Scholarships, *General***
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.

*Application forms are available from The Secretary, Department of Education, AAEF Travel Grants, PO Box 826, Woden, ACT 2606.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
Gowrie Scholarship Trust Fund	$3500 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 15 November.
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 early August.
Frank Knox Memorial Fellowships at Harvard University	Stipend of $5600 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
The Rhodes Scholarship*	Approximately £3000 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 early September each year.
Rothmans Fellowships Award‡	$16500 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.

Applied Science

Australian Pig Industry Research Committee Postgraduate Awards	$6850 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 15 September
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†		Minimum 2 years. Maximum 3 to 4 years.	Awarded for research into the beef and cattle industry leading to the award of the Masters or PhD degree. Applications close 31 July.

**Application forms must be obtained from the Australian representative of the Fund, Mr L. T. Hinde, Reserve Bank of Australia, GPO Box 3947, Sydney, NSW 2001. These must be submitted to the Registrar by early August.

*Applications to Mr H. McCredie, 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
Faculties of Applied Science and Engineering		
Institution of Engineers, Australia	Medal and 100.00	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 Chemical Engineering and Industrial Chemistry		
Abbott Laboratories Pty Ltd	100.00	Bachelor of Engineering degree course in Chemical Engineering – Year 4
The Australian Gas Light Company's in Chemical Engineering	50.00	Subject selected by Head of School
Australian Paper Manufacturers Ltd	100.00	Best result in 48.163 Instrumentation and Process Control in Industrial Chemistry
	100.00	48.163 Instrumentation and Process Control I – in Chemical Engineering
Chamber of Manufactures of New South Wales	50.00	Subject selected by Head of School
Chemical Technology Society	25.00	Bachelor of Science in Industrial Chemistry
	25.00	Bachelor of Science degree course in Industrial Chemistry, Years 1 and 2 or Stages 1 to 4

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Chemical Engineering and Industrial Chemistry (continued)		
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 the second year or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course
	100.00	General proficiency in the third year or its part-time equivalent in either the Chemical Engineering course or the Industrial Chemistry course
	100.00	General proficiency in the fourth year 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	Best performance in 48.135 Thermodynamics
Stauffer Australia Limited	50.00	Subject selected by Head of School
Western Mining Corporation Ltd	150.00	Best overall performance in 48.036 Chemical Engineering Laboratory I
	150.00	Best overall performance in 48.044 Chemical Engineering Laboratory II
Department of Fuel Technology		
Australian Institute of Energy	50.00	For a fuel subject or allied subject project
Shell	100.00	Subject selected by Head of School
School of Food Technology		
Wilfred B. S. Bishop	20.00	General proficiency throughout Bachelor of Science degree course in Food Technology
Cottees General Foods	120.00	38.141 Food Regulation and Control

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Metallurgy		
Alcan Australia Ltd	100.00	Subject selected by Head of School
Austral Crane	150.00	
Australian Institute of Metals	50.00 and one year's membership of the Institute	
Australian Welding Institute	30.00 Book order	
Chamber of Manufactures of New South Wales	50.00	
The Broken Hill Proprietary Co Ltd	100.00	
The Electrolytic Refining and Smelting Co of Australia Ltd	40.00	
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	80.00	Subject selected by Head of School
School of Mining Engineering		
Joint Coal Board	125.00	Bachelor of Engineering degree course in Mining Engineering, Year 2
	125.00	Bachelor of Engineering degree course in Mining Engineering, Year 3
	250.00	Bachelor of Engineering degree course in Mining Engineering — general proficiency throughout course
Western Mining Corporation Ltd	150.00	Best overall performance in final year of Bachelor of Engineering degree course
	150.00	General proficiency throughout the Bachelor of Engineering degree course
	150.00	Best overall performance in penultimate year of Bachelor of Engineering degree course

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Textile Technology		
J. B. Speakman	20.00	Undergraduate thesis
R. J. Webster	100.00	General proficiency throughout the Bachelor of Science degree course in Textile Technology
School of Wool and Pastoral Sciences		
Bayer Animal Health	1000.00	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 50.00 payable to University Co-op Bookshop Limited	Meat Science
P. R. McMahon Memorial	100.00	Excellence in Wool Science
Parkes Wool Promotion Committee	A shield held in the School of Wool and Pastoral Sciences on which the successful student's name is engraved each year	Bachelor of Science degree course in Wool and Pastoral Sciences, Year 3

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	48.381G Atmospheric Pollution and Control, or a subject of an equivalent nature, taken by students in graduate courses in the School of Chemical Engineering

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Barry William Edenborough, BE PhD *N.S.W.*
Michael David Young, BSc PhD *N.S.W.*, ATI
Oto Zubzanda, DipIng *T.U. Bratislava*, PhD *N.S.W.*

Senior Instructor

Ronald Edward Sallaway

Administrative Officer

John Edward Lawrence

Professional Officer

Ian Rowden McRae, BSc (Forestry) *A.N.U.*

School of Wool and Pastoral Sciences

Associate Professor and Head of School

John Patrick Kennedy, MSc *N.S.W.*, BSc *Oxf.*, MAIAS

Professor of Pastoral Sciences

Haydn Lloyd Davies, PhD *W.Aust.*, BSc *Wales*, MAIAS

Associate Professors

John William James, BA *Qld.*, DSc *N.S.W.*
Walter Raghnall McManus, BScAgr *Syd.*, PhD *N.S.W.*
Euan Maurice Roberts, MAgrSc *N.Z.*, PhD *N.S.W.*

Senior Lecturers

Stephen James Filan, BAgrEc *N.E.*, MSc *N.S.W.*
John Douglas McFarlane, BScAgr DipEd *Syd.*, MSc *N.S.W.*, MAIAS
Douglas McPherson Murray, BAgrSc PhD *Melb.*, MRurSc *N.E.*
Archibald Niven Sinclair, MVSc *Syd.*, FRCVS, FACBS, FACVS

Lecturer

Dennis Charles Teasdale, BSc MBA *N.S.W.*

The University of New South Wales Kensington Campus 1984

Theatres

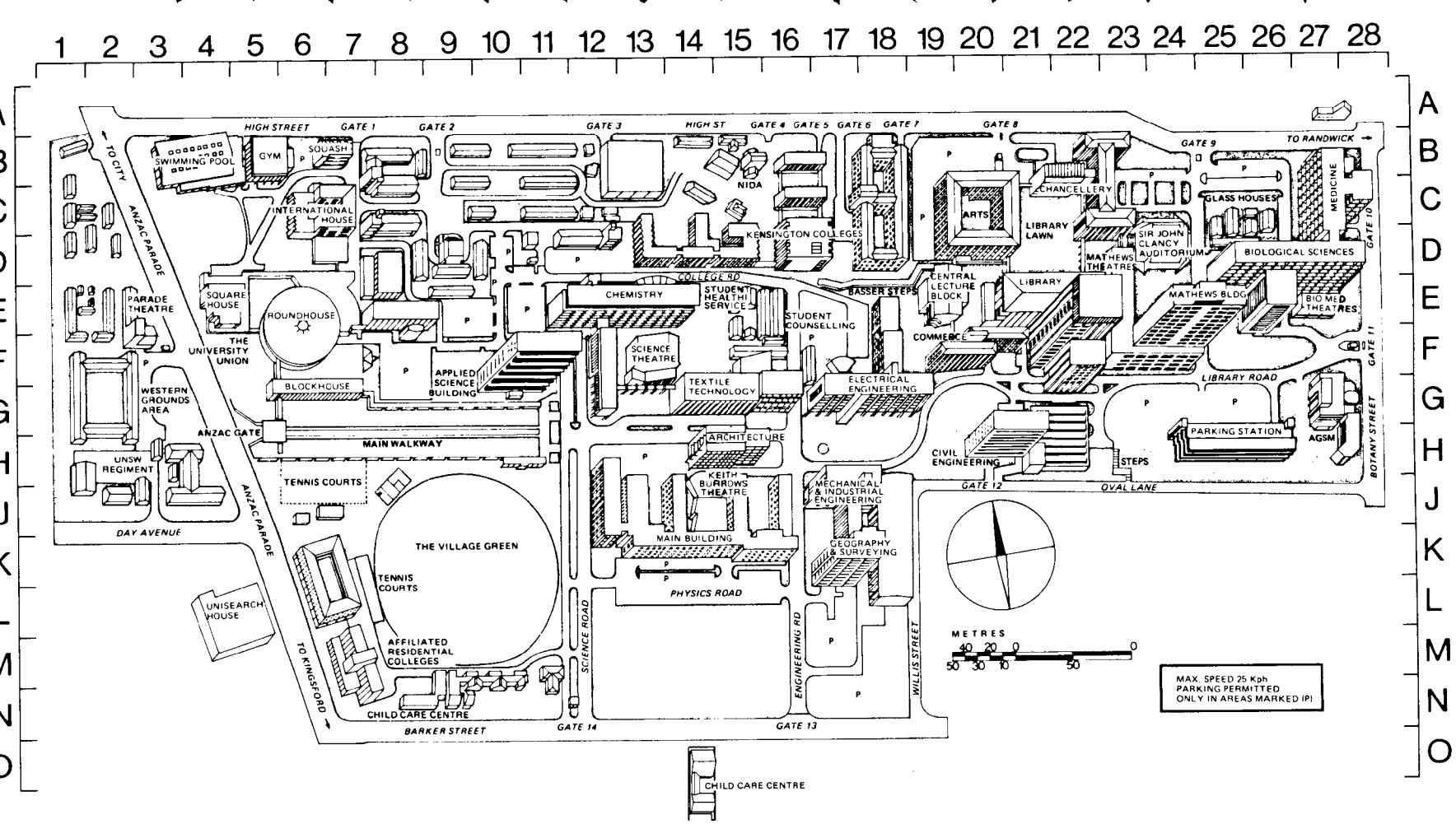
Biomedical Theatres E27
Central Lecture Block E19
Classroom Block (Western Grounds) H3
Rex Vowels Theatre F17
Keith Burrows Theatre J14
Main Building Theatrette K14
Mathews Theatres D23
Parade Theatre E3
Science Theatre F13
Sir John Clancy Auditorium C24

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
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
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 C22
Alumni and Ceremonials C22
Anatomy C27
Applied Geology F10
Applied Science (Faculty Office) F10
Architecture
(including Faculty Office) H14
Arts (Faculty Office) C20
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 C22
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
Closed Circuit Television Centre F20
Commerce (Faculty Office) F20
Committee in Postgraduate Medical
Education B27
Community Medicine D26
Computing Services Unit E21
Drama B10
Economics F20
Education G2
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 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 C1
Industrial Engineering J17
Institute of Rural Technology B8b
Japanese Economic and Management
Studies Centre F20
Kanga's House O14
Kindergarten (House at Pooh Corner) N8
Landscape Architecture K15
Law (Faculty Office) E21
Law Library E21
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 C15
Nuclear Engineering J17
Off-campus Housing C22
Optometry J12
Organizational Behaviour F20
Pathololgy C27
Patrol and Cleaning Services F20
Philosophy C20
Physics K15
Physical Education and
Recreation Centre (PERC) B5
Physiology and Pharmacology C27
Political Science C20
Postgraduate Extension Studies (Closed
Circuit Television) F20
Postgraduate Extension Studies (Radio
Station and Administration) F23
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 E15c
Student Health E15b
Student Records C22
Students' Union E4
Surveying K17
Teachers' College Liaison Office F15b
Tertiary Education Research Centre E15d
Textile Technology G14
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
KENSINGTON COLLEGES
ARTS
CHANCELLERY
LIBRARY LAWN
GLASS HOUSES
MEDICINE
SIR JOHN CLANCY AUDITORIUM
MATHEWS THEATRE
BIOLOGICAL SCIENCES
GATE 10
PARADE THEATRE
SQUARE HOUSE
ROUNDHOUSE
THE UNIVERSITY UNION
COLLEGE RD
CHEMISTRY
STUDENT HEALTH SERVICE
STUDENT COUNSELLING
BASSER STEPS
CENTRAL LECTURE BLOCK
LIBRARY
MATHEWS BLDG
BIO MED THEATRES
COMMERCE
SCIENCE THEATRE
APPLIED SCIENCE BUILDING
TEXTILE TECHNOLOGY
ELECTRICAL ENGINEERING
LIBRARY ROAD
GATE 11
BOTANY STREET
WESTERN GROUNDS AREA
BLOCKHOUSE
ANZAC GATE
MAIN WALKWAY
ARCHITECTURE
PARKING STATION
AGSM
CIVIL ENGINEERING
STEPS
UNSW REGIMENT
TENNIS COURTS
KEITH BURROWS THEATRE
MECHANICAL & INDUSTRIAL ENGINEERING
GATE 12
OVAL LANE
DAY AVENUE
THE VILLAGE GREEN
MAIN BUILDING
GEOGRAPHY & SURVEYING
TENNIS COURTS
PHYSICS ROAD
UNISEARCH HOUSE
AFFILIATED RESIDENTIAL COLLEGES
SCIENCE ROAD
ENGINEERING RD
WILLIS STREET
TO KINGSFORD
CHILD CARE CENTRE
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

This Handbook has been specially 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 $5.00 (plus postage $1.00, interstate $1.20).

The Handbooks vary in cost: Applied Science, Architecture, Arts, Commerce, Engineering, Professional Studies, and Sciences are $3.00. Postage is $1.00 in each case ($1.20 interstate). Law, Medicine and AGSM are $2.00. Postage is 60 cents in each case (70 cents interstate).

A set of books is $32.00. Postage is $2.00 ($4.50 interstate).

The General Studies Handbook is free. Postage is 60 cents (70 cents interstate).