The University of New South Wales

Applied Science

1980 Faculty Handbook

How to use this Handbook

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

General Information (the yellow 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.**

The University of New South Wales

Applied Science

1980 Faculty Handbook

The address of the University of New South Wales is:

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New South Wales, Australia 2033

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Telegraph: UNITECH, SYDNEY

Telex AA26054

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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 10 September 1979, 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 the University and its activities you should consult the University Calendar.

Note: All phone numbers below are University extension numbers. If you are outside the University, dial 663 0351 and ask for the extension or dial 662—and then the extension number. This prefix should only be used when you are certain of the extension that you require. Callers using 662 cannot be transferred to any other number.

Some people who can help you

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

The 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 students who need advice and who have problems and are not sure whom they should see. As well as dealing with general enquiries they are especially concerned with the problems of physically handicapped and disabled students and those in need of financial assistance. The latter students should see Mrs Beaumont. Enquire at room 148E, phone 2482 (general enquiries) or 3164 (financial assistance).

The Assistant Registrar (Admissions and Higher Degrees), Mr Jack Hill, is located on the ground floor of the Chancellery. General enquiries should be directed to 3715.

The Assistant Registrar (Examinations and Student Records), Mr Peter Wildblood is located on the ground floor of the Chancellery. For particular enquiries regarding the Student Records Unit, including illness and other matters affecting

performance in examinations, academic statements, graduation ceremonies, prizes, release of examination results and variations to enrolment programs, phone 3711. For information regarding examinations, including examination timetables and clash of examinations, contact the **Administrative Officer**, Mr John Grigg, phone 2143.

The Adviser for Prospective Students, Mrs Fay Lindsay, is located on the ground floor of the Chancellery and is available for personal interview. For an appointment phone 3453.

The Assistant Registrar (Student Employment and Scholarships), Mr Jack Foley, is located in the Chancellery. Enquiries should be directed to 2086 (undergraduate scholarships), 2525 (graduate scholarships) and 3259 (employment).

The Housing Officer, Mrs Judy Hay, is located in the Student Amenities and Recreation Section in the huts at the foot of Basser Steps. For assistance in obtaining suitable lodgings phone 3260.

The Student Health Unit is located in Hut E at the foot of Basser Steps. The Director is Dr Max Napthali. For medical aid phone 2679 or 3275.

The Student Counselling and Research Unit is located at the foot of Basser Steps. For assistance with educational or vocational problems ring 3681, 3685 or 2696 for an appointment.

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

The Chaplaincy Centre is located in Hut F at the foot of Basser Steps. For spiritual aid phone Anglican—2684; Catholic 2379; Greek Orthodox—2683; Lutheran—2683; Uniting Church—2685.

The Students' Union is located on the second floor of Stage III of the University Union, where the SU full-time President, Education Vice-President, Welfare-Research Officer, and Director of Overseas Students are available to discuss any problems you might have. In addition the SU offers a range of diverse services including legal advice (full-time solicitor available), clubs and societies services, second-hand bookshop (buy or sell), new records/tapes at discount, food shop (The Nuthouse), a professional nursery-kindergarten (House at Pooh Corner), a typesetting service, electronic calculators (bulk purchasing), an information referral centre (the Infakt Bus), a bail fund and publications such as *Tharunka*, Orientation Magazine, Concessions Book and counter-course handbooks. For information about these phone 2929.

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 session and there are short recesses of one week within each of the sessions.

Session 1 commences on the first Monday of March.

1980

Session 1	3 March to 11 May
(14 weeks)	*May Recess:* 12 May to 18 May
	19 May to 15 June
Tuesday	*Midyear Recess:* 16 June to 20 July
17 June	Examinations begin
Wednesday	
2 July	Examinations end
Session 2	21 July to 24 August
(14 weeks)	*August Recess:* 25 August to 31 August
	1 September to 2 November
Monday	
10 November	Examinations begin
Friday	
29 November	Examinations end

January

Tuesday 1	New Year's Day — Public Holiday
Friday 4	Last day for applications for review of results of *annual* examinations
Friday 11	Last day for acceptance of applications by Admissions Office for transfer to another undergraduate course within the University
Monday 28	Australia Day — Public Holiday

February

Monday 4	Enrolment period begins for new undergraduate students and undergraduate students repeating first year
Monday 18	Enrolment period begins for second and later year undergraduate students and graduate students enrolled in formal courses
	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 their degree for any other reason

March

Monday 3	**Session 1 commences**
Tuesday 4	List of graduands for April/May ceremonies and of 1979 prize-winners published in daily press
Friday 14	Last day for acceptance of enrolment by new undergraduate students (late fee payable)
Friday 28	Last day for acceptance of enrolment by undergraduate students re-enrolling in second and later years (late fee payable)

April

Thursday 3	*Confirmation of Enrolment* forms despatched to all students
Friday 4 to Monday 7	Easter
Friday 18	Last day for undergraduate students to discontinue without failure subjects which extend over Session 1 only
Friday 25	Anzac Day — Public Holiday

May

Monday 5	Last day for undergraduate students completing requirements for degrees or diplomas at the end of Session 1 to submit *Application for Admission to Degree* form
Monday 12	**May Recess begins**
Thursday 15	Publication of provisional timetable for June/July examinations
Sunday 18	**May Recess ends**
Friday 23	Last day for students to advise of examination timetable clashes

June

Tuesday 3	Publication of timetable for June/July examinations
Sunday 15	**Session 1 ends**
Monday 16	Queen's Birthday — Public Holiday
	Midyear Recess begins
Tuesday 17	Examinations begin

July

Wednesday 2	Examinations end
Tuesday 15	Examination results mailed to students
Wednesday 16	Examination results displayed on University noticeboards
Tuesday 15 to Friday 18	Students to amend enrolment programs following receipt of June examination results
Sunday 20	**Midyear Recess ends**
Monday 21	**Session 2 begins**
	Last day for application for review of June examination results
Thursday 31	Foundation Day (no classes held)

August

Friday 1	Last day for students to discontinue without failure subjects which extend over the whole academic year
Monday 25	**August Recess begins**
Sunday 31	**August Recess ends**

September

Friday 5	Last day for undergraduate students to discontinue without failure subjects which extend over Session 2 only
Monday 8	Last day for applications from undergraduate students completing requirements for degrees and diplomas at the end of Session 2 to submit *Application for Admission to Degree* forms
Wednesday 10	List of graduands for October graduation ceremonies published in daily press
Friday 12	Last day for students to discontinue without failure subjects which extend over Session 2 only
	Confirmation of Enrolment form forwarded to all students

Monday 15	Last day to notify intention of attending October graduation ceremonies
Monday 22	Last day for applications from undergraduate students completing requirements for degrees and diplomas at the end of Session 2 to submit *Application for Admission to Degree* form
Friday 26	Last day for acceptance of corrected *Confirmation of Enrolment* forms

October

Wednesday 1	Last day to apply to UCAC for transfer to another university in New South Wales
Thursday 2	Publication of provisional examination timetable
Monday 6	Eight Hour Day — Public Holiday
Thursday 9	Graduation ceremonies
Friday 10	Last day for students to advise of examination timetable clashes
Thursday 21	Publication of timetable for examinations

November

Sunday 2	**Session 2 ends**
Monday 3	**Study Recess begins**
Sunday 9	**Study Recess ends**
Monday 10	Examinations begin
Saturday 29	Examinations end

December

Tuesday 16	Examination results mailed to students
Wednesday 17	Examination results displayed on University notice boards
Thursday 25	Christmas Day — Public Holiday
Friday 26	Boxing Day — Public Holiday

Organization of the University

Rapid development has been characteristic of the University of New South Wales since it was first incorporated by an Act of Parliament in 1949, under the name of the New South Wales University of Technology.

In 1979 the University had 18,466 students and over 3,700 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 coat of arms of the University is reproduced on the front cover of this handbook. The arms were granted by the College of Heralds in London, on 3 March 1952, and its heraldic discription 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 in 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 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, and the Deputy Chancellor is Dr F.M. Mathews.

The Professorial Board

The Professorial Board is one of the two chief academic units within the University and includes all the professors from the various faculties. 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 these and similar matters are presented to Council for its consideration and adoption.

The Faculties/Boards of Study

The Dean, who is also a professor, is the executive head of the Faculty or Board of Study. Members of each Faculty or Board meet regularly to consider matters pertaining to their own areas of study 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 together with the Australian Graduate School of Management. In addition, the Board of Studies in General Education fulfils 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

Once courses of study have been approved they come under the control of the individual Schools (eg the School of Chemistry, the School of Mathematics). 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 Rupert Myers, is charged with managing and supervising the administrative, financial and other activities of the University.

He is assisted in this task by three Pro-Vice-Chancellors, Professor John Thornton, Professor Ray Golding and Professor Rex Vowels, 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 Keith Jennings, the Bursar, Mr Tom Daly, and the Business Manager (Property), Mr R.K. Fletcher.

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/Board. Elections are for a one-year term of office.

Open Faculty/Board Meetings

If you wish you may attend a Faculty/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 on completion of their final year.

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 no longer published in the Faculty handbooks. Separate lists are issued early in the year and are available at key points on the campus.

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

The University Library

The University libraries are mostly situated on the upper campus. The main library building (Menzies Library) houses 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.

There are also library services at other centres:

The Water Reference Library situated at Manly Vale (phone 948 0261) which is closely associated with the Physical Sciences Library.

The library at the Broken Hill Division in the W.S. and L.B. Robinson University College building. Phone Broken Hill (080) 6022.

The library at the Royal Military College, Duntroon ACT, serving the Faculty of Military Studies. Phone (062) 73 0427.

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 day and evening periods. The exact hours of opening vary during the course of the academic year.

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

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.

Kensington Colleges
The Kensington Colleges comprise Basser College, Goldstein College, and Philip Baxter College. They house 450 men and women students, as well as 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 students from Australia and up to twenty other countries. Preference is given to more senior undergraduates and graduate students. Apply in writing to the Warden, International House, PO Box 88, Kensington, NSW 2033.

New College
This Church of England College is open to all students without regard to race or religion. It has accommodation for approximately 220 students and is co-educational. Enquiries should be addressed to the Master, New College, Anzac Parade, Kensington, NSW 2033.

Shalom College
Shalom College 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. A comprehensive tutorial program is offered along with a wide variety of activities and opportunities to meet informally with members of the University staff. Non-resident membership is available to male students who wish to participate in College activities and make use of its facilities. Warrane is directed by the Catholic lay association Opus Dei. Apply in writing to the Master, Warrane College, PO Box 123, Kensington, NSW 2033.

Creston Residence
Creston Residence offers accommodation for 25 full-time undergraduate and graduate women students without restriction of denomination or nationality. Non-resident membership provides students with the opportunity to participate in the activities of the Residence and to make use of its facilities. Creston is directed by the Women's Section of Opus Dei, a Catholic lay association. Enquiries should be addressed to the Principal, 36 High Street, Randwick, NSW 2031.

Other Accommodation

Off-campus Accommodation

Students requiring other than College accommodation may contact the Housing Officer in the Student Amenities and Recreation Section for assistance in obtaining suitable lodging in the way of full board, room 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.

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, list of estate agents and hints on house-hunting are available on request.

Location: The Student Accommodation Service is located in the huts at the foot of Basser Steps. Phone 663 0351, extension 3260.

Student Employment and Scholarships

The Student Employment and Scholarships Section offers assistance with career employment for final year students and graduates of the University. This service includes the mailing of regular job vacancy notices to registered students, and a Careers Library containing information on various careers and employers.

Careers advice and assistance are also available to undergraduates. Students undertaking courses in Applied Science or Engineering which require course-related industrial or professional training experience are assisted to find such employment over the long vacation. Information and advice regarding cadetships and undergraduate and graduates scholarships is also available.

The service is located in the Chancellery.

Phone extension 3259 for employment and careers advice, extension 2525 for details of graduate awards and grants, and extension 2086 for undergraduate scholarship, cadetship and industrial training information.

Student Health

A student health clinic and first aid centre is situated within the University. It is staffed by three qualified medical practitioners, assisted by two nursing sisters. The medical service, although therapeutic, is not intended to entirely 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 for specialist opinion and/or treatment. 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 as well as first aid service in the case of injury or illness on the campus are available.

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

Appointments may be made by calling at the centre or by telephoning extension 2679 or 3275 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. These clinics are open to staff and students and appointments may be made for the Student Health Unit clinic by telephoning 698 9499, or for The Prince of Wales Hospital clinics by telephoning 399 0111.

Student Counselling and Research

The Student Counselling and Research Unit provides individual and group counselling for all students—prospective, established and graduate. Self-help programs are also available. Opportunities are provided for parents and others concerned with student progress to see members of the counselling staff.

The service which is free, informal and personal is designed to help students with planning and decision making, and a wide variety of concerns and worries which may be affecting personal, educational and vocational aspects of their lives.

The Unit pursues research into factors affecting student performance, and the published results of its research and experience are helpful in improving University and other counselling services, and the quality of student life.

Counselling appointments may be arranged during sessions and recesses between 9 am and 7 pm. Phone 663 0351, extension 3681, 3685 and 2696, or call at the Unit which is located at the foot of Basser Steps. Urgent interviews are possible on a walk-in basis between 9 am and 5 pm. Group counselling programs are offered both day and evening between 9 am and 9 pm by special arrangement. Self-help programs are arranged to suit the student's time and convenience.

Student Amenities and Recreation

In general the Student Amenities and Recreation Section seeks ways to promote the physical, social and educational development of students through their leisure time activities and to provide some services essential to their day-to-day University life.

The Section provides, for example, a recreational program for students and staff at the Physical Education and Recreation Centre; negotiates with the Public Transport Commission of NSW on student travel concessions and supplies concession forms for bus, rail, ferries and planes; assists students with off-campus housing; makes bookings for use of sports facilities; and, in consultation with the Sports Association, assists various recognized clubs.

The Section is located in the huts at the foot of Basser Steps. The various services may be contacted by phone on the following extensions: Recreation Program 3271; Travel 2617; Accommodation 3260; Ground Bookings 2235; Sports Association 2673.

Physical Education and Recreation Centre

The Student Amenities 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, a 50m heated indoor swimming pool, and a main building, the latter containing a large gymnasium and practice rooms for fencing, table tennis, judo, weight-lifting, karate and jazz ballet, and a physical fitness testing room. The recreational program includes intramurals, teaching/coaching, camping, and fitness testing. The Centre is located on the lower campus adjacent to High Street. The Supervisor at PERC may be contacted on extension 3271.

The Sports Association

The Sports Association caters for a variety of competitive sports for both men and women. Membership is compulsory at $11 per year for all registered students and is open to all members of staff and graduates of the University.

The Sports Association office is situated in the huts at the foot of Basser Steps, and the control of the Sports Association is vested in the General Committee. The Sports Association may be contacted on extension 2673.

Student Travel Concessions

The Student Amenities and Recreation Section arranges distribution of bus, rail and ferry concessions. For the peak period during the week preceding and the first week of Session 1 distribution is at a location to be decided. Students should watch for notices around the campus announcing the distribution centre.

For the rest of the year students seeking authorization for travel concessions, including planes, should enquire at the section (extension 2617) or the Enquiry Desk, Chancellery (extension 2251).

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 (Stage 2) and the Squarehouse (Stage 3). Membership of the Union is compulsory at $55 per year for all registered students and is open to all members of staff and graduates of the University.

The full range of facilities provided by the Union includes a cafeteria service and other dining facilities, a large shopping centre, cloak room, banking and hairdressing facilities, showers, a women's lounge, common, games, reading, meeting, music, practice, craft and dark rooms. 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. Exhibitions are held in the John Clark Gallery.

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.

The Students' Union

The Students' Union is run by students and represents them on and off campus. Presidential elections are by popular vote and all students who have completed one year at the University are eligible for election. The President directs the entire administration of the Students' Union and its activities.

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

Membership is compulsory at $17 per annum for full-time students and $13 for part-time students.

The activities of the Students' Union include:

1. Infakt: a student-run information referral service. If you want someone to talk to or need help of any kind see the people at Infakt located in the bus at the foot of Basser Steps.
2. A casual employment service.
3. Organization of Orientation Week.
4. Organization of Foundation Day.
5. A nursery/kindergarten, *The House at Pooh Corner.*
6. Publication of the student paper *Tharunka.*
7. A free legal service run by a qualified lawyer employed by the Students' Union Council.
8. Students' Union Record Shop which sells discount records and tapes.
9. The Nuthouse which deals in bulk and health foods.

10. Secondhand Bookshop for cheap texts.
11. Clubs and societies which receive money from the Students' Union through CASOC (Clubs and Societies on Campus).
12. The sale of electronic calculators and accessories at discount rates.
13. Provision of a bail fund.

The Students' Union is located on the second floor, Stage 3, the Union.

Chaplaincy Centre

This service is provided for the benefit of students and staff of various religious and spiritual beliefs. Chaplains are in attendance at the University at regular times. A Chapel is also available for use by all denominations. For further details, turn to page 2.

Other Services and Activities

CASOC All clubs and societies on campus (except sporting clubs) are loosely organized under the umbrella of CASOC, which is a committee of the Students' Union. Some of these clubs are: the Motor Cycle Club; Chess Club; Dramsoc; Opunka; Kite Club and the Jazz Society.

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

University Co-operative Bookshop Limited Membership is open to all students, on initial payment of a fee of $10, refundable when membership is terminated. Members receive an annual rebate on purchases of books.

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.

Australian Armed Forces Enquiries should be directed to:

Royal Australian Navy Royal Australian Navy Liaison Officer, Emeritus Professor J.S. Ratcliffe, Commander, RANR (Rtd), International House. Phone extension 3093 or 663 0473.

University of New South Wales Regiment The Adjutant, Regimental Depot, Day Avenue (just west of Anzac Parade). Phone 663 1212.

Royal Australian Air Force Undergraduates interested in the RAAF Undergraduate Scheme should contact The Recruiting Officer, Defence Forces Recruiting Centre, 323 Castlereagh Street, Sydney. Phone 212 1011.

Financial Assistance to Students

Tertiary Education Assistance Scheme

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

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

- Undergraduate and graduate bachelor degree courses
- Graduate diploma courses
- Approved combined bachelor degree courses
- Master's qualifying courses (one year)

Benefits

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

1979 Higher School Certificate candidates and tertiary students receiving an allowance are sent forms in January 1980. Other students may obtain forms from the Admissions Section *or* Student Employment and Scholarships Section, *or* from the Commonwealth Department of Education, 59 Goulburn Street, Sydney, NSW 2000 (phone 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 1980, otherwise benefits will not be paid for the earlier months of the year.

Scholarships, Cadetships, Prizes

1. *Undergraduate Scholarships* In addition to finance provided under the Commonwealth Government's Tertiary Education Assistance Scheme there are a number of scholarships, cadetships, prizes and other forms of assistance available to undergraduate students. Details of procedures for application for these awards are contained in the Calendar.

There are also special scholarships not administered by the University, information about which may be obtained from the appropriate School office.

Further information and advice regarding scholarships is available from the Student Employment and Scholarships Section in the Chancellery.

2. *Graduate Awards* An honors degree is generally an essential requirement for gaining one of the many graduate

scholarships which are available at the University. Therefore gifted students should not neglect the opportunity to qualify for honours and thus become eligible for an award.

Details of graduate awards are contained in the Calendar.

Other Financial Assistance

In addition to the Tertiary Education Assistance Scheme financed by the Commonwealth 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 the Students' Union, the University Union and other 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. Repayment usually commences after graduation or upon withdrawal from the course. 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 Australian Government's Aboriginal Study Grant Scheme. Furthermore, the University may assist Aboriginal students with loans to meet some essential living expenses.

All enquiries relating to the latter should be made at the office of the Deputy Registrar (Student Services), Room 148E, in the Chancellery.

Fund for Physically Handicapped and Disabled Students

The University has a small fund (started by a generous gift from a member of the staff who wishes to remain anonymous) available for projects of benefit to handicapped and disabled students. Enquiries 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 some agreed ways of doing things in order to operate for the benefit of all members. The rules and procedures listed below will affect you at some time or another. In some cases there are penalties (eg fines or exclusion from examinations) for failure to observe these procedures and therefore they should be read with care.

Admission

Where can I get information about admission?

The Admissions Office, located in the Chancellery on the upper campus, provides information for students on admission requirements, undergraduate and graduate courses and enrolment procedures. The Admissions Office is open from 9 am to 5 pm Monday to Friday (excluding the lunch hour 1 pm to 2 pm). During enrolment the office is also open for some part of the evening.

The Office provides information about special admission (including mature age entry), admission with advanced standing and admission on overseas qualifications. The Office also receives applications 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 lodgment of applications are adhered to. For further details see the sections below on **Enrolment and Fees.**

Applications for admission to undergraduate courses from students who do not satisfy the requirements for admission (see section on **Admission Requirements** in the Calendar), from

students seeking admission with advanced standing, or from students who have a record of failure at another university, are referred by the Admissions Office to the Admissions Committee of the Professorial Board.

Students seeking to register as higher degree candidates should first consult the Head of the School in which they wish to register. An application is then lodged on a standard form and the Admissions Office, 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 Admissions Office or the Universities and Colleges Admissions Centre.

How do I qualify admission?

In order to enter an undergraduate course you must qualify for matriculation to the University, and be selected for admission to the Faculty or course you wish to enter. Full details of matriculation and admission requirements are contained in the Calendar and in a pamphlet obtainable at the Admissions Office.

Enrolment

How do I enrol?

All students, except those enrolling as graduate research students (see below), must lodge an authorized enrolment form with the Cashier on the day the enrolling officer signs the form or on the day their General Studies electives are approved if the course requires this.

All students, except those enroling as graduate research students and those exempted (see below), should on that day also *either* pay the required fees *or* lodge an enrolment voucher or other appropriate authority.

For details of the locations and hours for enrolment see *Enrolment Procedures 1980*, a free booklet obtainable from the Admissions Office or from your School or Faculty Office.

What happens if I am unable to pay fees at the time of enrolment?

If you are unable to pay fees by the due date you may apply to the Deputy Registrar (Student Services) for an extension of time, which may be granted in extenuating circumstances.

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 that time (see **Fees** below) unless the student has permission from the Deputy Registrar (Student Services). 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.

New Undergraduate Enrolments

Persons who are applying for entry in 1980 must lodge an application for selection with the Universities and Colleges Admissions Centre, PO Box 7049, GPO, Sydney 2001, by 1 October 1979.

Those who are selected will be required to complete enrolment at a specified time before the start of Session 1. Compulsory 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 Admissions Office.

Re-enrolment

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 Admissions Office 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, PO Box 7049, GPO, Sydney 2001, by 1 October 1979.

Restrictions Upon Re-enrolling

Students enrolled for the first time in any undergraduate course in the University who failed more than half their program in 1979; students who have failed more than once a subject prescribed as part of their course; and students required by the Re-enrolment Committee to show cause should not attempt to re-enrol but should follow the written instructions they will receive from the Registrar.

For the purpose of calculating a student's program, all subjects taken during the year, including repeat subjects, are counted.

Miscellaneous Enrolments

Students may be permitted to enrol as miscellaneous students in subjects not counted as part of (ie a degree or diploma) provided the Head of the School offering the subject considers it will be of benefit and there is accommodation available. Only in exceptional cases will subjects taken in this way count towards a degree or diploma. Students who are under exclusion may not be enrolled as miscellaneous students in subjects which may be counted towards courses from which they have been excluded.

Students seeking to enrol as miscellaneous students should obtain a letter of approval from the Head of the appropriate

School or his representative permitting them to enrol in the subject concerned. The letter should be given to the enrolling officer at the time of enrolment.

Final Dates for Completion of Enrolments

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 (14 March 1980) 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 (28 March 1980) except with the express approval of the Deputy Registrar (Student Services) and the Heads of Schools concerned. No enrolments for courses in Session 2 only will be accepted after the end of the second week of Session 2 (1 August 1980) except with the express approval of the Deputy Registrar (Student Services) and the Heads of Schools concerned.

How do assisted students (eg scholarship holders) enrol?

Scholarship holders or sponsored students who have an enrolment voucher or letter of authority from their sponsor should present it at the time of enrolment. 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 must pay the 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.

What special rules apply if I wish to be considered for admission with advanced standing?

If you make application to register as a candidate for any degree or other award granted by the University you may be admitted to the course of study with such standing on the basis of previous attainments as may be determined by the Professorial Board. For complete details regarding 'Admission with Advanced Standing' consult the Calendar.

Can I transfer from one course to another?

To transfer from one course to another you must apply on an application form obtainable from the Admissions Office by Friday 11 January 1980. If your application is successful you are required to comply with the enrolment procedures for the year/stage of the new course and, unless otherwise instructed, you should present the letter granting transfer to the enrolling officer. If you intend to transfer, you should also inform the enrolling officer of the School in which you were enrolled in 1979.

Can I change my course program?

If you wish to seek approval to substitute one subject for another, or add one or more subjects to your program or discontinue part or all of your program, you must make application to the Registrar through the office controlling your course, from which application forms are available. The Registrar will inform you of the decision. Application to enrol in additional subjects must be submitted by 28 March 1980 for Session 1 only and Whole Year subjects and by 15 August 1980 for Session 2 only subjects.

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

Withdrawal from courses and subjects

Courses

1. Students withdrawing from courses (see also **Subjects**, below) are required to notify the Registrar in writing. In some cases students will be entitled to fee refunds.

For details see the Calendar.

Subjects

2. 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 subject concerned, except in exceptional circumstances.

(1) for one session subjects, the end of the seventh week of that session (18 April or 5 September)

(2) for whole year subjects the end of the second week of Session 2 (1 August)

How do I enrol after an absence of twelve months or more?

If you have had an approved leave of absence for twelve months or more and wish to resume your course you should follow the instructions about re-enrolling given in the letter granting your leave of absence. If you do not fully understand or have lost these instructions, then you should contact the Admissions Office before November in the year preceding the one in which you wish to resume your course.

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

Are there any restrictions upon students re-enrolling?

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

First-year Rule

1. A student enrolled in the first year of any undergraduate course of study in the University as set out in the relevant faculty handbook shall be required to show cause why he/she should be allowed to continue the course if he/she fails more than half the program in which he/she is enrolled. In order that students may calculate half their program, the weighting of subjects in each course is defined in *Schedule A**, which may be varied from time to time by the Professorial Board.

Repeated-failure Rule

2. A student shall be required to show cause why he/she should be allowed to repeat a subject which that student has failed more than once. *Where the subject is prescribed as part of the student's course he/she shall also be required to show cause why he/she should be allowed to continue that course.*

General Rule

3. A student shall be required to show cause if, in the opinion of the faculty or board of studies, his/her academic record is such as to demonstrate the student's lack of fitness to pursue a subject or subjects and/or course or courses.

The Session-unit System

4. (1) A student who infringes the provision of Rules **1.** or **2.** at the end of Session 1 of any year will not be required to *show cause* at that time but 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 that course.

(2) Such a student will be required to *show cause* at the end of the year, except that a student who has infringed Rule **2.** at the end of Session 1, repeats the subject(s) in question in Session 2, and passes it/them, will not be required to *show cause* on account of any such subject.

Exemption from Rules by Faculties

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

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

'Showing Cause'

6. (1) A student wishing to *show cause* must apply for special permission to re-enrol. Application should be made on the form available from the Examinations and Student Records Section 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 Re-enrolment Committee which shall determine whether the cause shown is adequate to justify the granting of permission to re-enrol.

Appeal

7. (1) Any student who is excluded by the Re-enrolment Committee from a course and/or subject(s) under the provisions of the Rules may appeal to an Appeal Committee constituted by Council for this purpose with the following membership:

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

The Chairman of the Professorial Board, of if he 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.

(2) The notification to any student of a decision by the Re-enrolment Committee to exclude him/her from re-enrolling in a course and/or subject(s) shall indicate that the student may appeal against that decision to the Appeal Committee. In lodging such an appeal with the Registrar the student should provide a complete statement of all grounds on which the appeal is based.

*For details of Schedule A see **Restrictions upon Re-enrolling** in the Calendar.

(3) The Appeal Committee shall determine the appeal after consideration of the student's academic record, his/her application for special permission to re-enrol, and the stated grounds of appeal. In exceptional circumstances, the Appeal Committee may require the student to appear in person.

Exclusion

8. (1) A student who is required to *show cause* under the provisions of Rules **1.** or **3.** and either does not attempt to *show cause* or does not receive special permission to re-enrol from the Re-enrolment Committee (or the Appeal Committee on appeal) shall be excluded from re-enrolling in the subject(s) and course(s) on acount of which he was required to *show cause.* Where the subjects failed are prescribed as part of any other course (or courses) he/she shall not be allowed to enrol in any such course.

(2) A student who is required to *show cause* under the provisions of Rule **2.** and either does not attempt to *show cause* or does not receive special permission to re-enrol from the Re-enrolment Committee (or the Appeal Committee on appeal) shall be excluded from re-enrolling in any subject he/she has failed twice. *Where the subject failed is prescribed as part of the student's course he/she shall also be excluded from that course.* Where the subject failed is prescribed as part of any other course (or courses) he/she shall not be allowed to enrol in any such course(s).

(3) A student excluded from a course or courses under the provisions of Rule **1.** or **2.** may not enrol as a miscellaneous student in subjects which may be counted towards any such course.

Re-admission after Exclusion

9. (1) An excluded student 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 which re-admission is sought. Such applications will be considered by the Admissions Committee of the relevant Faculty or Board.

(b) An application for re-admission to a subject should be made to the Registrar before 30 November in the year prior to which re-admission is sought. Such applications will be considered by the relevant Head of School.

(3) An application 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 an applicant's capacity to resume studies at the University.

(4) Applications for re-admission to a course or subject that are unsuccessful (see **9.** (2) (a), (b) respectively) will be reconsidered automatically by the Re-enrolment Committee of the Professorial Board. The decision of the Committee will be final.

10. If students fail a subject at the examinations in any year or session and re-enrol in the same course in the following year or session they must include in their program 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.

How do I apply for admission to degree or diploma?

If your current program will enable you to complete all requirements for a degree or diploma, including industrial training where necessary, you should complete the form *Application for Admission to a Degree* by the dates shown in the **Calendar of Dates** (see page 2) and on the *Notification of Examination Results.* The forms are available from the Enquiry Counter in the north wing of the Chancellery and will be mailed to all potential graduates.

The completion and submission of the form ensures that:

1. The correct spelling and sequence of names is recorded on the degree certificate. **2.** Any previous academic qualifications are shown in the graduation ceremony program. **3.** All correspondence relating to the ceremony is forwarded to the correct address. ***Note:*** If notifying change of address after the form has been submitted an additional form *Final Year Students' Graduation: Change of Address* should be submitted.

If you meet all the requirements, the degree or diploma will be conferred without the necessity for further action by you. Students should advise the Registrar, in writing, if they do not wish to have the degree or diploma conferred for any reason, including the decision to proceed to an honours degree. To ensure that the degree is not conferred advice should reach the Registrar no later than 24 July 1980 for students completing at the end of Session 1, and 1 March 1981 for those completing at the end of Session 2.

Fees

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

Do I have to pay for tuition?

No tuition fees are charged.

What other fees and charges are payable?

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

How much is my contribution to student activities and services on campus?

All students (with the exceptions noted below) will be required to pay the following fees if enrolling for a program involving two sessions. Those enrolling for only one session will pay one-half of the Student Activities Fees, and the full University Union entrance fee, if applicable.

University Union Entrance Fee

Payable on first enrolment	$25

Student Activities Fees

University Union, annual subscription	$55
Sports Association, annual subscription	$11
Students' Union	
Students enrolling in full-time courses, annual subscription	$17
Students enrolling in part-time courses and miscellaneous subjects, annual subscription	$13
Miscellaneous annual fee	$25

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

Are fees charged for examinations?

Generally, there are no charges associated with examinations; however two special examination fees are applied:

Examinations conducted under special circumstances—for each subject	$11
Review of examination result—for each subject	$11

What penalties exist for late payment of fees?

The following additional charges will be made in 1980 when fees are paid late:

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.

Locations and Hours of Cashier

Cashier's Offices are open during the enrolment periods. Details of locations and hours are listed in *Enrolment Procedures 1980*, a free booklet obtainable from your School or Faculty Office or from the Admissions Office.

Who is exempt from payment of fees?

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

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 fees mentioned 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 in a miscellaneous subject or 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.

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 graduate 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 1, 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.

Is exemption from membership possible?

The Registrar is empowered to grant exemption from membership 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.

How much will textbooks and special equipment (if any) cost?

You must 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.

Will I receive any refund if I withdraw from a course?

Yes. The following rules apply:

1. If you withdraw from courses you are required to notify the Registrar in writing.

2. Where notice of withdrawal from a course is received by the Registrar before the first day of Session 1 a refund of all fees paid will be made. After that time only a partial refund will be made. See the Calendar for details.

What happens if I fail to pay the prescribed fees or charges?

If you fail to pay prescribed fees or charges or become otherwise indebted to the University and you fail to make a satisfactory settlement of your indebtedness upon receipt of due notice then you cease to be entitled to the use of University facilities. You will not be permitted to register for a further session, to attend classes or examinations, or be granted any official credentials. In the case of a student enrolled for Session 1 only or for Sessions 1 and 2 this disbarment applies if any portion of fees is outstanding after the end of the eighth week of Session 1 (25 April 1980). In the case of a student 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 (29 August 1980).

In special cases the Registrar may grant exemption from disqualifications referred to in the preceding paragraph upon receipt of a written statement setting out all relevant circumstances.

Can I get an extension of time to pay?

If you apply before the due date and extenuating circumstances exist, an extension of time may be granted. Apply to the Deputy Registrar (Student Services).

Examinations

When are examinations held?

Examinations for Session 2 and for Whole Year subjects are held in November/December. Examinations for Session 1 subjects are held during the Midyear Recess. Provisional timetables indicating the dates and times of examinations and notices of the location of examinations are posted on the University notice boards on the campus, including the Western Grounds Area. Final timetables indicating the dates, times, locations and authorized aids are available for students two weeks before the end of each session. You must advise the Examinations Unit (the Chancellery) of any clash in examinations. Details of dates are published in the **Calendar of Dates** (see pages 2-4 for May/June and October/November).

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

In the assessment of your progress in courses, 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.

How are examination passes graded?

Passes are graded: High Distinction, Distinction, Credit and Pass. Satisfactory indicates the satisfactory completion of a subject for which graded passes are not available. A Pass Conceded may be granted to a student whose mark in a subject is slightly below the standard required for a pass but whose overall satisfactory performance warrants this concession.

A Pass Conceded In a subject will normally allow progression to another subject for which the former subject is a prerequisite. In a particular subject, however, a subject authority may specify that a pass conceded is insufficient to meet a particular subject prerequiste.

When are examination results available?

Final examination results will be posted to your term address (which can be altered up to 30 November) or to your vacation address (fill in a form obtainable at the Enquiry Desk, Chancellery, also by 30 November). Results are also posted on School noticeboards and in either the University library or the foyer of the Sir John Clancy Auditorium. No examination results are given by telephone.

Can examinations results be reviewed?

Examination results may be reviewed for a fee of $11 a subject, which is refundable in the event of an error being discovered. This review consists mainly of ensuring that all questions attempted have been marked and of checking the total of the marks awarded. Applications for review must be submitted on the appropriate form to the Examinations and Student Records Section together with the necessary fee not later than fifteen working days after the issue of the *Notification of Results* form.

A review of a result is not a detailed assessment of a student's standard of knowledge and understanding of, and skills in, the subject.

Are allowances made if students are sick before or during an examination?

A student who through serious illness or other cause outside his control *is unable to attend an examination* is required to bring the circumstances (supported by a medical certificate or other evidence) to the notice of the Registrar *not later than seven days after the date of the examination*, unless there are exceptional circumstances.

A student who believes that his performance in a subject has been affected by serious illness *during the year* or by other cause outside his control, and who desires these circumstances to be taken into consideration in determining his standing, is required to bring the circumstances (supported by a medical certificate or other evidence) to the notice of the Registrar as soon as the circumstances are known but *not later than seven days after the date of the examination*, unless there are exceptional circumstances.

A student who attempts an examination, yet claims that his performance is prejudiced by sickness *on the day of the examination* must notify the Registrar or Examination Supervisor *before, during, or immediately after the examination*, and may be required to submit to medical examination.

When submitting a request for consideration candidates are required to give details of their registration number, address, course, specialization, year or stage, full or part-time and subject number, title and date of the examination affected.

A student suffering from a physical disability which puts him at a disadvantage in written examinations should apply to the Assistant Registrar, Examinations and Student Records Section (Ground Floor, the Chancellery) immediately the disability is known. If necessary, special arrangements will be made to meet the student's requirements.

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.

Compulsory Industrial Training

Examinations including deferred 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 Unit, immediately the location of the industrial training is known. Special forms for this purpose are available at the Enquiry Desk, in the north wing of the Chancellery.

Arrival at Examinations

Examination rooms will be open to students 25 minutes before the commencement of the examination, Candidates are requested to be in their places at least 15 minutes before the commencement to hear announcements. The examination paper will be available for reading 10 minutes before commencement.

Use of Linguistic Dictionaries

All answers must be in English unless otherwise directed. Foreign students who have the written approval of the Assistant Registrar, Examinations and Student Records Section, may use standard linguistic dictionaries. Dictionaries should be presented for approval not later than 14 days before the commencement of the examination period.

How are examinations conducted?

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 15 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 30 minutes from the time of commencement of the examination.

5. Candidates shall not be permitted to leave the examination room before the expiry of 30 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 an 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.

Abolition of Deferred Examinations

The system of formal deferred examinations administered by the Registrar's Division was abolished from 1 March 1978. Schools and Faculties may carry out whatever additional assessment may be considered appropriate, including assessment or additional assessment on medical or compassionate grounds.

Can I buy copies of previous examination papers?

Yes—for 5¢ each from the University Union's Upper Campus Shop in the Commerce Building.

Essays

Should I list my sources?

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

Student Conduct on Campus

Is there a detailed code of rules related to the general conduct of students?

No. The University has not considered it necessary to formulate a detailed code of rules relating to the general conduct of students.

Now that you have become a member of the University you should understand that this involves an undertaking on your part to observe its rules, By-laws and other requirements, and to pay due regard to any instructions conveyed by any officer of the University.

What are the rules related to attendance at classes?

You are expected to be regular and punctual in attendance at all classes in the course or subject in which you are enrolled. All applications for exemption from attendance at lectures or practical classes must be made in writing to the Registrar.

In the case of illness or of absence for some other unavoidable cause you may be excused by the Registrar for non-attendance at classes for a period not more than one month or, on the recommendation of the Dean of the appropriate Faculty, for a longer period. Applications should be addressed to the Registrar and, where applicable, should be accompanied by a medical certificate. If assessment procedures have been missed, this should be stated in the application.

If you attend less than 80per cent of possible classes, you may be refused final assessment in that subject.

Why is my University and Union card important?

All students enrolled for courses leading to degrees and/or diplomas, except those exempt from fees, are issued with a University and Union membership card. Your card must be carried during attendence at the University and shown on request.

The number appearing on the front of the card above your name is your student registration number used in the University's records. This number should be qouted 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 some inconvenience in completing re-enrolment.

If you lose your card it is important to notify the University Union as soon as possible.

New students will be issued with cards on enrolment.

Why should I inform the University if I change my address?

If you change your address you should notify the Student Records Section of the Registrar's Division as soon as possible. Failure to do this could lead to important correspondence (including examination results) not reaching you. The University cannot accept responsibility if official communications fail to reach students who have not notified their change of address. *Change of Address Advice* forms are available at Faculty and School offices and at the Enquiry Desk in the north wing of the Chancellery.

All communications from the University, including examination results, will be sent to the session address. Change of address advice will be accepted up to 30 November, except for final-year students wishing to change their *Submissions of Details Associated with Graduation* form. Changes to this form will be accepted up to a date four weeks before the student's graduation ceremony.

Will the University release information to third parties without my permission?

In general, no. The University treats examination results 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 impractible 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, there are sometimes accusations made that the University has revealed information, including addresses (especially to insurance companies).

All students should be aware that students' addresses are eagerly sought by various commercial agents and that sometimes tricks are used to obtain them. For example, from time to time 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 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.

How are student records kept up to date?

Enrolment details forms will be sent to all students on 24 April and 12 September. It is not necessary to return these forms unless any information recorded thereon is incorrect. Amended forms must be returned to the Examinations and Student Records Section within fourteen days. Amendments notified after the closing date will not be accepted unless exceptional circumstances exist and approval is obtained from the Registrar. Amended forms returned to the Registrar will be acknowledged in writing within 14 days.

Is there any rule related to the ownership of students' work?

Yes. 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 you as part of your courses, or submitted for any award or competition conducted by the University.

Can I get a permit to park on campus?

Only 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.

Lost property?

All enquiries concerning lost property should be made to the Superintendent on extension 3580 or to the Lost Property Office at the Union.

Further Information

Where can I get further information concerning courses, admission requirements, scholarships and enrolment procedure?

General

Any student who requires information on the application of these rules or any service which the University offers, may make enquiries in the Chancellery and in case of difficulties should visit the office of the Deputy Registrar (Student Services).

Notices

Official University notices are displayed on the noticeboards and students are expected to be aquainted 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), Electrical Engineering Building, Main Building (Physics and Mining Engineering) and in the Western Grounds Area.

Notices are placed on the University noticeboards each month detailing forthcoming important dates. Any change to the **Calendar of Dates** is included in these notices.

Appeals

Section 5(c) of chapter III of the By-laws provides: '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'.

The Calendar

Please consult the Calendar if you want 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:

Full-Time Students

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

Thursday 28 February 1980
11 am in the Clancy Auditorium

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

Friday 29 February 1980
11 am in the Clancy Auditorium

Part-time Students

Thursday 28 February 1980
6.30 pm in the Clancy Auditorium

Meeting for Parents of New Students

Friday 29 February 1980
7.30 pm in the Clancy Auditorium

Foreword

The importance of the Applied Sciences 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, Biogeography and Bioclimatology, Geomorphology and Pedology), Applied Geology, Chemical Engineering (including Biological Process Engineering and Fuel Engineering), Chemical Technology (including Industrial Chemistry and Ceramic Engineering), Food Technology, Metallurgy (including 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:

Dr J. Collins, Executive Officer, Faculty of Applied Science.
Room 122, Sir Robert Webster Building, Tel. 662 2162.

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

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

Mr R. Starr, Senior Administrative Officer, School of Chemical Engineering.
Room 322, Applied Science Building, Tel. 662 2976.

Mr J. Gatenby, Senior Administrative Officer, School of Chemical Technology.
Room 510, Applied Science Building, Tel. 662 2404.

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

Mr B. McClenaghan, Administrative Assistant, School of Geography.
Room G10, Geography and Surveying, Tel. 662 2084.

Mr R. Ball, Senior Administrative Officer, School of Metallurgy.
Room 110B, Metallurgy Building, Tel. 662 2351.

Mr W. Huisman, Administrative Assistant, School of Mining Engineering.
Room 51B, Main Building, Tel. 662 2912.

Dr T. Hickie, Senior Lecturer, School of Textile Technology.
Room 121, Sir Robert Webster Building, Tel. 662 2323.

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

Faculty of Applied Science Enrolment Procedures

All students re-enrolling in 1980 should obtain a copy of the free booklet *Enrolment Procedures 1980* 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 serves the information needs of senior undergraduate students, graduate students and members of the academic staff. It contains books, a large collection of journals, and guides to the literature in the form of abstracting and indexing journals in the subject areas of pure and applied science, technology, engineering and architecture. The library also houses a growing map collection and some micro form material. All material housed in the library bears the prefix 'P' and is indexed in the central catalogue on Level 2. There is also a catalogue in the Physical Sciences Library. There is seating for approximately 300 people, and a number of room carrels and seminar rooms are available for use. Photocopying facilities are provided. Journals may not be borrowed from the collection. Staff on Level 7 are ready 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 new 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 stage of the course if their performance in at least two of the above disciplines is of a sufficiently high standard (credit level or better).

For further 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 normally 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 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 degree.

3. The degree shall be awarded in the pass or honours grade. 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 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 in the pass grade 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, Chemical Technology, 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, Ceramic Engineering, 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 Chemical Engineering, Metallurgical Process Engineering and Mining Engineering.

Honours: Candidates for honours 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 in 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' aproved practical work. In Mining Engineering students will undertake a program of practical training of at least 100 days.

Part-time Courses

Six-year, part-time courses leading to the award of the degree of Bachelor of Science (Technology) are offered by the School of Food Technology; in Ceramics and Industrial Chemistry by the School of Chemical Technology; in Metallurgy by the School of Metallurgy; and in Mineral Processing by the School of Mining Engineering (at Broken Hill only). The part-time Mining Engineering course leading to the award of the degree of Bachelor of Science (Engineering) is available at Broken Hill.

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) 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 the second and third years 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.

School of Applied Geology

Head of School
Professor G. J. S. Govett

Administrative Officer
Mr G. J. Baldwin

The structure and syllabus of the BSc degree course in Applied 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 students receive instruction in standard fundamental geological subjects. As the course progresses, emphasis is increasingly placed on practical applications in engineering and environmental geology, mineral and energy deposits, and mineral exploration techniques including geological, geochemical and geophysical methods.

Attendance at the University for students taking the full-time professional course in Applied Geology is for twenty-eight weeks per year on the basis of two sessions of fourteen weeks each for four years. At least one session of the fourth year is devoted essentially to field and laboratory work on a specialized research project.

A three-year full-time course is available to students in the Faculty of Science, and provision is made for party-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, Applied Geophysics and in Mineral Exploration are offered by the School. These courses are designed to provide specialist training in these areas of Applied Geology.

3000
Applied Geology — Full-time (New Course)
Bachelor of Science
BSc

Year 1

		Hours per week S1	S2
1.001	Physics I *or*		
1.011	Higher Physics	6	6
2.121	Chemistry IA *and*		
2.131	Chemistry IB	6	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
25.110	Earth Materials and Processes*	6	0
25.120	Earth Environments and Dynamics*	0	6
		24	24

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

Year 2

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
	General Studies Elective	1½	1½
		13½	13½

Students take Ancilliary Subjects for a total of not less than 10 hpw. Subjects are selected preferably from the following list. Other subjects, however, may be taken conditional on approval of the Head of School.

Ancilliary Subjects

2.002A	Physical Chemistry	6	*or*	6
2.002C	Inorganic Chemistry	6	*or*	6
5.010	Engineering A	6	*or*	6
5.020	Engineering B	6	*or*	6
10.031	Mathematics	2		2
10.301	Statistics SA or 10.331 Statistics SS	2		2
15.001	Microeconomics I	3½	*or*	3½
15.011	Macroeconomics I	3½	*or*	3½
17.031	Cell Biology	6		0
17.021	Biology of Higher Organisms	0		6

*Field work of up to 3 days, equivalent to 7 tutorial hours is an essential part of the subject.
†Field work of up to 10 days, equivalent to 28 tutorial hours is an essential part of the subject.

Year 3* (Offered 1981)

		Hpw S1	S2
25.311	Earth Materials III	6	0
25.321	Earth Materials IV**	0	6
25.312	Earth Environments II	6	0
25.313	Exploration and Data Processing§	6	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
25.326	Geological Techniques	0	6
	General Studies Electives	3	3
		27	27

*Students taking Year 3 in 1980 should refer to the old course below.
**Field work of up to 7 days is an essential part of the subject.
§Field work of up to 5 days is an essential part of the subject.
†Field work of up to 6 days is an essential part of the subject.

Year 4* (Offered 1982)

25.411	Resource Geology**	8½	0
and either			
25.412	Mineral and Energy		
or	Resources†	12½	24
25.413	Engineering and Environmental Resources	12½	24
	General Studies Elective	3	0
		24	24

*Students taking Year 4 in 1980 should refer to the old course below.
**Field work of up to seven days duration is a compulsory part of this subject.
†May include all or some combination of the following subjects as determined by the Head of School:

7.013	Principles of Mining
7.023	Mineral Process Engineering
7.214	Mine Economics and Planning

3000
Applied Geology — Full-time (Old Course)
Bachelor of Science
BSc

Year 3*

		Hpw
25.013	Geology IIIA†	6
25.023	Geology IIIB**	6
25.033	Geology IIIC§	12
	Two General Studies Electives	3
		27

*Not available after 1980.
†Field work of up to 6 days is a compulsory part of this subject.
**A geological survey camp of 10 days' duration is a compulsory part of this subject.
§Field tutorials constitute an essential part of this subject.

Year 4*

		Hpw S1	S2
7.013	Principles of Mining	2	0
7.023	Mineral Process Engineering	2	0
or			
25.074	Special Project	4	0
plus			
25.014	Geology IV: Advanced Applied Geology**	6	0
25.024	Geology IV: Project	0	24
	One General Studies Elective	3	0
Plus *one* of the following subjects:			
25.034	Geology IV: Engineering Geology	11	0
25.044	Geology IV: Mineral Exploration	11	0
25.054	Geology IV: Sedimentary Basins	11	0
25.064	Geology IV: Applied Geophysics	11	0
		24	24

*Not available after 1981.
**Field work up to seven days' duration is a compulsory part of this subject.

School of Chemical Engineering

Head of School
Professor R. T. Fowler

Senior Administrative Officer
Mr R. F. Starr

The School of Chemical Engineering consists of the Departments of Biological Process Engineering. Chemical Engineering and Fuel Technology. The courses in Chemical Engineering contain a number of electives in technical areas, including biological process engineering and fuel engineering.

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.

For the award of honours, 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 courses obtain a minimum of twelve weeks' professionally oriented, or industrial experience. Students in the part-time courses must complete three years of industrial training concurrently with their University work.

Department of Chemical Engineering

3040
Chemical Engineering — Full-time Course

Bachelor of Engineering
BE

This course extends over four years and students study full-time during the day for twenty-eight weeks of each year (excluding examination and recess periods).

Successful completion of the BE degree course is accepted by the Council of Engineering Institutions, UK, the Institution of Engineers, Australia, and the Royal Australian Chemical Institute as sufficient 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	6	6
5.010	Engineering A	6	0
5.030	Engineering C (includes 3.011 Introduction to Chemical Engineering)	0	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		24	24

Year 2

		Hpw S1	S2
2.002A	Physical Chemistry	6	0
2.002C	Inorganic Chemistry	0	6
3.021	Chemical Engineering IA	5	0
3.022	Chemical Engineering IB	0	6
3.311	Fuel Engineering I*	2	2
4.961	Materials and Corrosion	0	2
6.832	Electrical Machines	0	3
8.112	Structures	3	0
10.031	Mathematics	2	2
10.331	Statistics SS	2	2
	Two General Study Electives	3	3
		23	26

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

Year 3

2.002B	Organic Chemistry	6	0
3.031	Chemical Engineering IIA	5	0
3.032	Chemical Engineering IIB	5	0
3.033	Chemical Engineering IIC	0	5
3.034	Chemical Engineering IID	0	5
3.035	Chemical Engineering IIE	0	5
3.036	Chemical Engineering Laboratory I	2	3
10.032	Mathematics	2	2
	General Study Elective	1½	1½
		21½	21½

Plus *one* of the following electives:

3.321	Fuel Engineering II	3	3
7.313	Minerals Engineering Processes	3	3
18.121	Production Management	3	3
22.113	Industrial Chemistry Processes	3	3
44.111	Microbiology	3	3
	Any other elective approved by Head of School		

Year 4

3.041	Chemical Engineering IIIA	4	0
3.042	Chemical Engineering IIIB	4	0
3.043	Chemical Engineering IIIC	5	0
3.044	Chemical Engineering Laboratory II	3	0
	Advanced Chemical Engineering Electives	0	6
	Project*	1	11
	General Study Elective	1½	1½
		18½	18½

Plus *one or more* of the following to a total of 6 hrs/week for 28 weeks:

		Hours per week S1	S2
	Advanced Chemical Engineering Electives	6	6
3.040	Chemical Engineering Projects	6	6
3.0461	Introductory Reservoir Engineering	2	0
3.0462	Advanced Reservoir Engineering	0	2
3.211	Biological Process Engineering	6	6
3.331	Fuel Engineering III	6	6
4.121	Principles of Metal Extraction	3	3
7.314	Mineral Process Technology	3	3
18.551	Operations Research	3	3
23.051	Nuclear Power Technology	3	3
	Any other elective approved by Head of School		

*The project is to be selected from:
3.040 Chemical Engineering Projects
3.240 Biological Process Engineering Project
3.340 Fuel Engineering Project

Chemical Engineering — Subjects and Units

		Hpw S1	S2
3.011	**Introduction to Chemical Engineering**	0	2
3.021	**Chemical Engineering IA**		
	Unit 1 Flow of Fluids	2	0
	2 Dimensions	1	0
	3 Material Balances	2	0
		5	0
3.022	**Chemical Engineering IB**		
	Unit 1 Heat Transfer I	0	2
	2 Pumps and Pumping	0	1
	3 Thermodynamics I	0	2
	4 Computations I	0	1
		0	6
3.023	**Chemical Engineering Science I —** (Applicable to Science programs) Consists of: 3.021 *and* Units 1,2 and 4 of 3.022	5	4
3.024	**Chemical Engineering Principles I** (Applicable to Mathematics programs) Consists of: Unit 1 of 3.021 *and* Units 1 and 2 of 3.022	2	3
3.025	**Chemical Engineering for Chemical Technologists** Consists of: Units 1 and 2 of 3.021 *and* Units 1 and 2 of 3.022	3	3
3.031	**Chemical Engineering IIA**		
	Unit 1 Mass Transfer (theory)	2	0
	2 Heat Transfer II (theory)	1	0
	3 Thermodynamics II	2	0
		5	0
3.032	**Chemical Engineering IIB**		
	Unit 1 Reaction Engineering I	1	0
	2 Plant Layout I	1	0
	3 Process Engineering I	1	0
	4 Economics I	1	0
	5 Process Report	1	0
		5	0
3.033	**Chemical Engineering IIC**		
	Unit 1 Fluid-Particle Systems I	0	2
	2 Multicomponent Separation	0	1
	3 Thermodynamics III	0	1
	4 Solids Handling	0	1
		0	5
3.034	**Chemical Engineering IID**		
	Unit 1 Reaction Engineering II	0	2
	2 Process Dynamics I	0	1
	3 Instrumentation	0	1
	4 Computations II	0	1
		0	5
3.035	**Chemical Engineering IIE**		
	Unit 1 Mass Transfer Design	0	1½
	2 Heat Transfer II (Design)	0	1
	3 Process Vessels	0	1½
	4 Design Report	0	1
		0	5

		Hours per week S1	S2
3.036	**Chemical Engineering Laboratory I**		
	Unit 1	2	0
	2	0	3
		2	3
3.037	**Chemical Engineering Science II** (Applicable to Science programs) Consists of 3.031, Unit 1 of 3.032, Units 1, 2 and 3 of 3.033 *and* Units 1 and 4 of 3.034		
		6	7
3.038	**Chemical Engineering Principles II** (Applicable to Mathematics programs) Consists of: Units 1 and 2 of 3.031 *and* Units 1 and 2 of 3.033		
		6	7
3.041	**Chemical Engineering IIIA**		
	Unit 1 Convective Mass Transfer	1	0
	2 Simultaneous Heat and Mass Transfer	1	0
	3 Surface Separation Processes	1	0
	4 Transport Phenomena	1	0
		4	0
3.042	**Chemical Engineering IIIB**		
	Unit 1 Process Dynamics II	1	0
	2 Control I	2	0
	3 Optimization	1	0
		4	0
3.043	**Chemical Engineering IIIC**		
	Unit 1 Safety and Failure Engineering	1	0
	2 Economics II	2	0
	3 Atmospheric Pollution Control	1	0
	4 Water Pollution Control	1	0
		5	0

		Hours per week S1	S2
3.044	**Chemical Engineering Laboratory II**	3	0

Advanced Chemical Engineering Electives

3.0451	Plant Layout II	0	2
3.0452	Chemical and Phase Equilibria	0	2
3.0453	Control II	0	2
3.0454	Reactor Engineering	0	2
3.0455	Fluid-Particle Systems II	0	2
3.0456	Process Engineering II	0	2
3.0457	Oil and Gas Processing	2	0

Students are to select *6 session hours only*. It is hoped that some of the above electives will be offered in *Session 1*.

3.040	**Chemical Engineering Projects**	1	11
3.0461	Introductory Reservoir Engineering	2	0
3.0462	Advanced Reservoir Engineering	0	2
3.211	**Biological Process Engineering**	6	6
3.240	Biological Process Engineering Project	1	11

Fuel Engineering — Subjects and Units

3.311	**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

NB Two units each session, but are interchangeable.

3.321	**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

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

		Hours per week S1	S2
3.331	**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
3.340	**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	6	6
5.010	Engineering A	6	0
5.030	Engineering C Includes 3.011 Introduction to Chemical Engineering	0	6
		12	12

Stage 3

2.002A	Physical Chemistry	6	0
2.002C	Inorganic Chemistry	0	6
10.031	Mathematics	2	2
10.331	Statistics SS	2	2
	General Studies Elective	1½	1½
		11½	11½

Stage 4

3.021	Chemical Engineering IA	5	0
3.022	Chemical Engineering IB	0	6
3.311	Fuel Engineering I*	2	2
4.961	Materials and Corrosion	0	2
6.832	Electrical Machines	0	3
8.112	Structures	3	0
	General Studies Elective	1½	1½
		11½	14½

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

Stage 5

3.031	Chemical Engineering IIA	5	0
3.032	Chemical Engineering IIB	5	0
3.033	Chemical Engineering IIC	0	5
3.034	Chemical Engineering IID	0	5
10.032	Mathematics	2	2
	General Studies Elective	1½	1½
		13½	13½

Stage 6

2.002B	Organic Chemistry	6	0
3.035	Chemical Engineering IIE	0	5
3.036	Chemical Engineering Laboratory I	2	3
	General Studies Elective	1½	1½
		9½	9½

		Hours per week S1	S2
Plus *one* of the following electives:			
3.321	Fuel Engineering II	3	3
7.313	Minerals Engineering Processes	3	3
18.121	Production Management	3	3
22.113	Industrial Chemistry Processes	3	3
44.111	Microbiology	3	3
	Any other elective approved by Head of School		

Stage 7

As per Year 4 of full-time course.

Department of Biological Process Engineering

Biological Process Engineering at the undergraduate level is a course in Chemical Engineering with electives in the areas of microbiology and biological process engineering.

3040 Chemical Engineering with Biological Process Engineering Electives — Full-time Course

Bachelor of Engineering
BE

Year 1 is the same as for the Chemical Engineering course; Years 2, 3 and 4 are also the same as for the corresponding years in Chemical Engineering, but in Year 3 the appropriate elective is 44.111 Microbiology; and in Year 4, 3.211 Biological Process Engineering, plus 3.240 Biological Process Engineering Project.

Successful completion of this degree course is sufficient qualification for corporate membership of the institution of Engineers, Australia, the Royal Australian Chemical Institute, and the Institution of Chemical Engineers, UK.

Department of Fuel Technology

This department, the first of its kind to be established in Australia, offers a course designed to meet the need of Australian industrial and research establishments for graduates trained in the science and technology of fuels and their utilization.

One constant problem of industries is that of developing and improving methods of processing and using solid, liquid and gaseous fuels to suit the continuously shifting patterns of demand. It is in this field of activity that the university-trained fuel technologist has a most important part to play.

In Australia, there is a growing need for people trained in the technology of fuels, and opportunities for employment and advancement of fuel engineers are therefore good.

Many exciting and revolutionary possibilities are apparent in the fuel and energy conversion industries, and there is a wide and varied field of activity which offers opportunity and challenge in the application of science and engineering to the problems of fuel and energy conversion, combustion engineering and environmental pollution control. Opportunities for graduate studies and research for higher degrees in these areas are wide-ranged and interesting.

The institute of Fuel (UK) has accepted the degree courses in Chemical Engineering with the Fuel Electives as providing exemption from the examination required for admission to corporate membership of the Institute.

Successful completion of the BE degree course in Chemical Engineering with Fuel Electives is accepted by the Australian Institute of Energy, the Council of Engineering Institutions, UK, the Royal Australian Chemical Institute, and the Institution of Engineers, Australia, as sufficient academic qualification for corporate membership.

3040 Chemical Engineering with Fuel Electives — Full-time Course

Bachelor of Engineering
BE

Fuel Engineering is essentially a course in Chemical Engineering with an orientation to the fuel and energy conversion and utilization industries. This course is available as an elective strand in the Chemical Engineering BE degree course. Years 1 and 2 are the same as for the Chemical Engineering course, and all students take the subject 3.311 Fuel Engineering I in their second year; Years 3 and 4 are also the same as for the corresponding years in Chemical Engineering, but in Year 3 the appropriate elective is 3.321 Fuel Engineering II, and in Year 4, 3.331 Fuel Engineering III, and 3.340 the Fuel Engineering Project.

The electives are devoted to professional subjects covering 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 heat recovery appliances; coal and oil conversion processes; energy conservation; and progress in fuel science and fuel processing.

School of Chemical Technology

Head of School
Professor D. L. Trimm

Senior Administrative Officer
Mr J. R. Gatenby

Chemical technology 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 chemical technology. There are two major specializations: Ceramic Engineering (full-time course) and Ceramics (part-time course) and Industrial Chemistry (full-time and part-time).

It is recommended that before graduation students in the full-time courses obtain a minimum of eight weeks' professionally oriented or industrial experience. Students in the part-time courses must complete an approved program of industrial experience of not less than twelve months prior to the award of the degree.

3100
Industrial Chemistry — Full-time Course

Bachelor of Science
BSc

Year 1

		Hours per week
1.001	Physics I	6
2.121	Chemistry IA *and*	
2.131	Chemistry IB	6
10.001	Mathematics I	6
Plus:		
25.011	Geology I	6
or any two of:		
5.010	Engineering A* *and*	6
5.030	Engineering C*†	6
17.031	Cell Biology* *and*	6
17.021	Biology of Higher Organisms*	6
		24

*One session only.
†Chemical Technology students take 22.101 Introduction to Chemical Technology in 5.030.

Year 2

		Hpw S1	Hpw S2
2.002A	Physical Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
2.002B	Organic Chemistry	1½	4½
6.851	Electronics and Instrumentation	3	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
22.112	Chemical Process Equipment	0	2
22.122	Instrument Analysis	4	4
22.132	Industrial Chemistry Calculations	3	1
	General Studies Elective	1½	1½
		23	23

Year 3

2.003B	Organic Chemistry	5	1
3.025	Chemical Engineering for Chemical Technologists	3	3
22.113	Industrial Chemistry Processes	3½†	3½†
22.123	Chemical Thermodynamics and Kinetics	4	3
22.133	Data Processing	4	3
22.163	Instrumentation and Process Control I	0	3§
22.303	Polymer Science	2	4†
	Two General Studies Electives	3	3
		24½	23½

†Laboratories operate for 4 hour periods in alternate weeks.
§Laboratories operate for 3 hour periods in alternate weeks.

Year 4

18.121	Production Management	3	3
22.114	Processes	0	2
22.124	Applied Kinetics	3	0
22.134	Applied Thermodynamics	2	0
22.154	Process Simulation	3	1
22.164	Instrumentation and Process Control II	5	0
22.174	Seminars	3	3
22.184	Process Analysis	2	2
22.194	Project (Industrial Chemistry)	6	8
	General Studies Elective	1½	1½
		28½	20½

With the approval of the Head of School, students may substitute either 22.314 Polymer Chemistry and 22.324 Physical Chemistry of Polymers II or 22.334 Polymer Physics II for 22.114 Processes.

3110
Industrial Chemistry — Part-time Course
Bachelor of Science (Technology)
BSc(Tech)

Stages 1 and 2*

		Hours per week
1.001	Physics I	6
2.121	Chemistry IA *and*	
2.131	Chemistry IB	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I	6
Plus:		
25.011	Geology I	6
or any two of		
5.010	Engineering A† *and*	6
5.030	Engineering C†§	6
17.031	Cell Biology† *and*	6
17.021	Biology of Higher Organisms†	6

*Physics and Mathematics are usually taken in Stage 1 and the other subjects in Stage 2.
†One session only.
§Chemical Technology students take 22.101 Introduction to Chemical Technology in 5.030.

Stage 3

		S1	S2
2.002B	Organic Chemistry	0	6
6.851	Electronics and Instrumentation	3	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
22.112	Chemical Process Equipment	0	2
	General Studies Elective	1½	1½
		8½	13½

Stage 4

2.002A	Physical Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
22.122	Instrumental Analysis	4	4
22.132	Industrial Chemistry Calculations	3	1
	General Studies Elective	1½	1½
		14½	12½

Stage 5

3.025	Chemical Engineering for Chemical Technologists	3	3
22.113	Industrial Chemistry Processes	3½*	3½*
22.303	Polymer Science	2	4*
	General Studies Elective	1½	1½
		10	12

*Laboratories operate for 4 hour periods in alternate weeks.

Stage 6

2.003B	Organic Chemistry	5	1
22.123	Chemical Thermodynamics and Kinetics	4	3
22.133	Data Processing	4	3
22.163	Instrumentation and Process Control*	0	3
		13	10

*Laboratories operate for 3 hour periods in alternate weeks.

3020
Ceramic Engineering — Full-time Course
Bachelor of Science
BSc

Year 1

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

†Ceramic Engineering students take 22.231 Introductory Ceramic Engineering in 5.030.

Year 2

1.9322	Physics (Introduction to Solids)	0	3
2.002A	Physical Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
2.002D	Analytical Chemistry	6	0
4.961	Materials and Corrosion	0	2
6.851	Electronics and Instrumentation	3	0
8.112/2	Structures	3	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
22.232	Ceramic Engineering I	0	3
	General Studies Elective	1½	1½
		23½	19½

Year 3

3.025	Chemical Engineering for Chemical Technologists	3	3
3.311	Fuel Engineering I	2	2
7.023	Mineral Process Engineering	2	0

		Hpw S1	S2
22.123A	Chemical Thermodynamics	2	2
22.153	Material and Energy Balances	3	0
22.163	Instrumentation and Process Control I	0	3†
22.213	Chemical Ceramics	6	5
22.233	Ceramic Process Principles	3½	3½
25.201	Mineralogy	2	2
	General Studies Elective	1½	1½
		25	22

†Laboratories operate for 3 hour periods in alternate weeks.

Year 4

18.131	Operations Research	0	3
22.164	Instrumentation and Process Control II	5	0
22.224	Physical Ceramics	6	6
22.234	Ceramic Engineering II	4	4
22.294	Project (Ceramic Engineering)	6	9
	Two General Studies Electives	3	3
		24	25

3030
Ceramics — Part-time Course
Bachelor of Science (Technology)
BSc(Tech)

Stages 1 and 2*

		Hours per week
1.001	Physics I	6
2.121	Chemistry IA *and*	
2.131	Chemistry IB	6
5.010	Engineering A**	6
5.030	Engineering C**§	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I†	6

*Physics and Mathematics are usually taken in Stage 1 and the other subjects in Stage 2.
**One session only.
§Ceramics students take 22.231 Introductory Ceramic Engineering in 5.030.
†There are no evening lectures in this subject.

Stage 3

		S1	S2
1.9322	Physics (Introduction to Solids)	0	3
2.002A	Physical Chemistry	6	0
6.851	Electronics and Instrumentation	3	0
10.031	Mathematics	2	2
10.301	Statistics SA	2	2
		13	7

Stage 4

		Hpw S1	S2
2.042C	Inorganic Chemistry	0	6
2.002D	Analytical Chemistry	6	0
4.961	Materials and Corrosion	0	2
8.112/2	Structures	3	0
22.132	Ceramic Engineering I	0	3
	General Studies Elective	1½	1½
		10½	12½

Stage 5

3.025	Chemical Engineering for Chemical Technologists	3	3
7.023	Mineral Process Engineering	2	0
22.153	Material and Energy Balances	3	0
22.163	Instrumentation and Process Control I	0	3†
22.233	Ceramic Process Principles	3½	3½
	General Studies Elective	1½	1½
		13	11

†Laboratories operate for 3 hour periods in alternate weeks.

Stage 6

3.311	Fuel Engineering I	2	2
22.123A	Chemical Thermodynamics	2	2
22.213	Chemical Ceramics	6	5
25.201	Mineralogy	2	2
	General Studies Elective	1½	1½
		13½	12½

School of Food Technology

Head of School
Professor R. A. Edwards

Administrative Assistant
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.

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. Graduates are able to pursue more advanced studies in any of these sciences.

Year 1

		Hours per week S1	S2
1.001	Physics I *or*		
1.021	Introductory Physics I	6	6
2.121	Chemistry IA *and*		
2.131	Chemistry IB	6	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I *or*	6	6
10.021B	General Mathematics IB *and*	6	0
10.021C	General Mathematics IC	0	6
17.021	Biology of Higher Organisms	0	6
17.031	Cell Biology	6	0
		24	24

Year 2

		Hpw S1	S2
2.002A	Physical Chemistry	3	3
2.002B	Organic Chemistry	0	6
2.002D	Analytical Chemistry	0	6
38:121	Food and Man	0	6
41.101	Introductory Biochemistry	12	0
44.143	Microbiology AS	10	0
	General Studies Elective	0	3
		25	24

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
38.331	Food Microbiology I	2	0
38.431	Food Engineering I	3	3
38.531	Nutrition	0	1
	General Studies Elective	0	3
		26	23

Year 4

38.140	Food Technology Project	8	8
38.141	Food Regulation and Control	4	0
38.146	Inspections	0	3
38.147	Food Quality Assessment	0	2
	General Studies Elective	1½	1½
	General Studies Advanced Elective	1½	1½
		15	16

Plus *two or more* of the following electives to a total of not less than 8½ hrs/week.

2.003B	Organic Chemistry	0	6
18.121	Production Management	3	3
18.551	Operations Research	3	3
28.012	Marketing Systems	4	0
28.022	Marketing Models	0	4

		Hpw S1	S2
38.142	Oenology	3	3
38.143	Cereal Technology	6	0
38.144	Treatment and Utilization of Food Processing Wastes	0	3
38.145	Marine Products Technology	2	0
38.148	Communications in Food Science and Nutrition	3	0
38.341	Food Microbiology II	0	6
38.344	Yeast Technology	0	3
38.442	Food Engineering II	3	3
38.541	Advanced Nutrition	3	0
38.542	Special Topics in Nutrition	0	3
38.543	Field and Laboratory Methods in Nutrition	0	3
42.102A	Biotechnology A	6	0
42.102B	Biotechnology B	0	6

or such other electives, to a total of not less than 8½ hrs/week, as approved by the Head of School.

During the second, third and fourth years of the course excursions are made to various food industries. Detailed reports of some of these visits are required.

A detailed report of the students's activities during his period in industry is required, and is taken into account in the classification for the honours list.

3070
Food Technology — Part-time Course
Bachelor of Science (Technology)
BSc(Tech)

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

The course covers the same subject matter as the first three years of the full-time course. For the first two years students follow a common course in which general biology is taken, and thereafter specialize in the biological sciences, which are fundamental to the study of food science and technology. The subjects of Stages 4, 5 and 6 may be available only in day-time classes, and substantial day-time release from industry may be required.

Students who have completed the requirements of this course and have qualified for the award of the degree of Bachelor of Science (Technology) may proceed to the award of the degree of Bachelor of Science by attending for one full-time year and completing the subjects listed in fourth year 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 of 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 *and*		
2.131	Chemistry IB	6	6
10.001	Mathematics I *or*	6	6
10.011	Higher Mathematics I† *or*		
10.021B	General Mathematics IB *and*	6	0
10.021C	General Mathematics IC	0	6
17.021	Biology of Higher Organisms	0	6
17.031	Cell Biology	6	0

*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	Analytic Chemistry	0	6
41.101	Biochemistry	12	0
	General Studies Elective	1½	1½
		13½	13½

Stage 4

2.002A	Physical Chemistry	0	6
38.121	Food and Man	0	6
44.143	Microbiology AS	10	0
	General Studies	1½	1½
		11½	13½

Stage 5

2.043L	Chemistry and Enzymology of Foods	6	6
10.301	Statistics SA	2	2
38.431	Food Engineering I	3	3
	General Studies Elective	1½	1½
		12½	12½

Stages 6

		Hours per week S1	S2
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	2	0
38.531	Nutrition	0	1
		15	9

There are elective specializations in biogeography and bioclimatology, geomorphology and pedology, or economic geography (with emphasis on urban geography). First year courses involve systematic studies of the physical or economic bases of geography. There is progressive specialization in the following years, but all courses in physical geography have common training in fundamental observation and data handling. For the award of honours, 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 quantitative techniques. Students need a battery-operated calculator; advice on appropriate machines may be obtained from the School Office. 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.

School of Geography

Head of School
Professor J. A. Mabbutt

Administrative Assistant
Mr B. McClenaghan

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 undertaking resource-inventory surveys and environmental assessment, and economic geographers are engaged as urban and regional planners and spatial analysts.

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.

3010
Applied Geography — Full-time Course
Bachelor of Science
BSc

Biogeography and Bioclimatology

Year 1

		Hours per week S1	S2
2.121	Chemistry IA *or*		
2.111	Introductory Chemistry	6	0
2.131	Chemistry IB	0	6
10.021B	General Mathematics IB *and*	6	0
10.021C	General Mathematics IC *or*	0	6
10.001	Mathematics I *or*	6	6
10.011	Higher Mathematics I		
17.031	Cell Biology	6	0
17.021	Biology of Higher Organisms	0	6
27.111	Applied Physical Geography I*	6	6
		24	24

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

Year 2

		Hpw S1	S2
1.001	Physics I *or*		
1.021	Physics IT	6	6
27.112	Applied Physical Geography II**	5	5
27.172	Environmental Measurements	1½	1½
27.631	Geographic Data Analysis I	0	4
43.111	Flowering Plants	6	0
43.101	Genetics *or*		
43.121	Plant Physiology	0	6
	Two General Studies Electives	3	3
		21½	25½

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

Year 3

27.133	Pedology**	0	5
27.143	Biogeography**	5	0
27.153	Climatology**	0	5
27.163	Methods in Physical Geography	1½	1½
27.173	Remote Sensing Applications†	0	3
27.183	Geomorphology**	5	0
43.142	Ecology and Environmental Botany	6	0
43.112	Plant Taxonomy *or*		
43.152	Plant Community Ecology *or*		
43.162	Plant Kingdom	0	6
	Two General Studies Electives	3	3
		20½	23½

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

Year 4

27.114	Land Resources Management†	4	0
27.344	Applied Biogeography and Bioclimatology**	8	0
27.504	Project (Biogeography and Bioclimatology)	6	16
27.514	Practical Applications in Geography	0	3
		18	19

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

Geomorphology and Pedology

Year 1

		Hours per week S1	S2
2.121	Chemistry IA *or*		
2.111	Introductory Chemistry	6	0
2.131	Chemistry IB	0	6
10.021B	General Mathematics IB *and*	6	0
10.021C	General Mathematics IC *or*	0	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
25.110	Earth Materials & Processes*	6	0
25.120	Earth Environments & Dynamics*	0	6
27.111	Applied Physical Geography I**	6	6
		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

1.001	Physics I *or*		
1.021	Introductory Physics I	6	6
25.211	Earth Materials I	6	0
25.221	Earth Materials II*	0	6
27.112	Applied Physical Geography II**	5	5
27.172	Environmental Measurements	1½	1½
27.631	Geographic Data Analysis I	0	4
	Two General Studies Electives	3	3
		21½	25½

*Field work of up to 3 days, equivalent to 7 tutorial hours, is an essential part of the subject.
**Up to 5 days' field work, equivalent to 40 tutorial hours, is an essential part of the subject.

Year 3

25.510	Geology for Geomorphologists and Pedologists	0	5
25.622	Hydrological and Coastal Surveying	3	3
27.133	Pedology**	0	5
27.143	Biogeography**	5	0
27.153	Climatology**	0	5
27.163	Methods in Physical Geography	1½	1½
27.173	Remote Sensing Applications†	3	0
27.183	Geomorphology**	5	0
	Two General Studies Electives	3	3
		20½	22½

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

Year 4

		Hours per week S1	S2
27.114	Land Resources Management†	4	0
27.234	Applied Geomorphology and Pedology*	8	0
27.514	Practical Applications in Geography	0	3
27.504	Project (Geomorphology and Pedology)	6	16
		18	19

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

Applied Economic Geography

Year 1

		Hpw S1	S2
10.021B	General Mathematics IB *and*	6	0
10.021C	General Mathematics IC *or*	0	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
15.001	Microeconomics I	3½	0
15.011	Macroeconomics I	0	3½
54.904	Political Science I	3½	3½
27.611	Applied Economic Geography I*	6	3
27.631	Geographic Data Analysis I	0	4
		19	20

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

Year 2

15.002	Microeconomics II	4	0
15.042	Macroeconomics II	0	4
54.213	Public Policy Making	0	3
27.612	Applied Economic Geography IIA	0	6
27.622	Applied Economic Geography IIB*	6	0
27.632	Geographic Data Analysis II	3	3
27.642	Mathematical Methods for Spatial Analysis	3	3
27.652	Geographic Information Systems	0	3
27.662	Urban Systems	4	0
		20	22

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

Year 3

		Hpw S1	S2
27.633	Geographic Data Analysis III	6	6
27.613	Applied Economic Geography III*	4	4

Plus *six* of the following, at least *two* subjects from economics and at least *two* subjects from geography:

15.003	Macroeconomics III	4	0
15.143	Microeconomics III	0	4
15.053	Economic Development	0	3
15.073	Natural and Environmental Resources Economics	3	0
15.082	Labour Economics	3	0
15.093	Public Sector Economics	0	3
15.163	Industrial Organisation and Policy	3	0
27.713	Marketing Geography†	0	4
27.723	Transport Geography†	0	4
27.733	Regional Policy and Planning†	4	0
27.743	Regional Population Analysis†	4	0
27.753	Social Welfare and Urban Development†	4	0
27.763	Rural Resource Problems†	0	4
27.773	Spatial Aspects of the Housing Market†	0	4
27.783	Spatial Impacts and Opportunities†	4	0
27.793	Models of Spatial Systems†	4	0
24.003G	Theory of Land Use/Transport Interaction‡	3	0
24.013G	Transport Economics‡	0	4
28.012	Marketing Systems	4	0
28.022	Marketing Models	0	4
54.065	Administration and Decision Making‡	3	0
		21	21

*Three days' field work, equivalent to 24 tutorial hours, is an essential part of the subject.
†Subject to the availability of staff in 1980.
‡By arrangement with Heads of Schools.

Year 4

27.504	Project	10	15
27.624	Geographic Thought and Perspectives	3	0
27.644	Seminars in Applied Geography	4	0
27.514	Practical Applications in Geography	0	3
		17	18

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
Professor H. Muir

Senior Administrative Officer
Mr R. A. Ball

The metallurgical profession is developing rapidly in importance in Australia, in keeping with the recent spectacular growth of our metal and mineral industry. In terms of value of production this industry has become recognized as one of Australia's most important, especially in terms of export earnings. Expansion of the industry has greatly enhanced the need for metallurgists.

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 first year of the full-time Bachelor of Science degree course consists of physics, chemistry, mathematics, and *either* engineering *or* geology. The structure of this Year 1 course is similar to that of many other science, applied science and engineering courses. Consequently, students may delay their final choice of a professional course until the end of Year 1.

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.

Candidates for the honours degree are required to undertake special reading and other assignments as directed by the Head of the School. In considering the award of honours special attention is paid to the performance of a candidate in the final year research project for which a thesis describing a theoretical or experimental study is required.

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 of 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 second and third years. During the second, third, and fourth years 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
1.001	Physics I *or*	6
1.011	Higher Physics I	6
2.121	Chemistry IA (Session 1) *and*	
2.131	Chemistry IB (Session 2)	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I	6
Plus one of:		
5.010	Engineering A *and*	
5.030	Engineering C *or*	6
25.011	Geology I	6
		24

Year 2

		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 Properties of Solids	4	0
4.602	Metallurgical Engineering I	0	5
4.802	Metallurgical Physics	0	2
10.031	Mathematics	2	2

		Hpw S1	S2
5.010	Engineering A† *and*	2	0
5.030	Engineering C† *or*	0	2
25.201	Mineralogy	2	2
	General Studies Elective	1½	1½
		24½	21½

†Part only.

Year 3

4.303	Chemical and Extraction Metallurgy II	5	5
4.403	Physical Metallurgy II	9	9
4.503	Mechanical Metallurgy	0	3
4.613	Metallurgical Engineering IIA	3	0
4.703	Materials Science	0	3
4.813	Mathematical Methods *or*	3	3
6.851	Electronics and Instrumentation *and*	3	0
6.852	Electrical Machinery and Supply	0	3
7.023	Mineral Process Engineering	2	0
	Two General Studies Electives	3	3
		25	26

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	1½	1½
		24½	24½

*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*	6	6
1.011	Higher Physics I	6	6
2.121	Chemistry IA *and*		
2.131	Chemistry IB	6	6
5.010	Engineering A *and*	6	0
5.030	Engineering C	0	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
		24	24

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 Properties of Solids	4	0
4.602	Metallurgical Engineering I	0	5
4.802	Metallurgical Physics	0	2
10.031	Mathematics	2	2
25.201	Mineralogy	2	2
	General Studies Elective	1½	1½
		24½	21½

Year 3

4.303	Chemical and Extraction Metallurgy II	5	5
4.433	Physical Metallurgy IIC	9	6
4.503	Mechanical Metallurgy	0	3
4.613	Metallurgical Engineering IIA	3	0
4.623	Metallurgical Engineering IIB	0	4
4.813	Mathematical Methods *or*	3	3
6.851	Electronics and Instrumentation *and*	3	0
6.852	Electrical Machinery and Supply	0	3
7.313	Minerals Engineering Processes	3	3
	Two General Studies Electives	3	3
		26	27

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	6	9
4.624	Metallurgical Engineering Project*	3	3
	General Studies Elective	1½	1½
		20	24½

Plus *one* of the following electives:

		Hpw S1	S2
3.043	Chemical Engineering IIIC — Units 1 and 2 *and*		
3.045	Advanced Chemical Engineering Electives — Unit 5	3	3
4.414	Physical Metallurgy IIIA	4½	0
7.314	Mineral Process Technology	3	3

*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.

Stages 1 and 2*

		Hours per week
1.001	Physics I	6
2.121	Chemistry IA *and*	
2.131	Chemistry IB	6
5.010	Engineering A *and*	
5.030	Engineering C	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I†	6

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

Stage 3

		S1	S2
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	3	3
		12	12

Stage 4

4.402	Physical Metallurgy I	6	6
4.502	Mechanical Properties of Solids	4	0
4.602	Metallurgical Engineering I	0	5
25.201	Mineralogy	2	2
		12	13

Stage 5

4.000	Metallurgy Special Topics	0	2
4.433	Physical Metallurgy IIC	9	6
4.503	Mechanical Metallurgy	0	3
6.851	Electronics and Instrumentation	3	0
	General Studies Elective	1½	1½
		13½	12½

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
6.852	Electrical Machinery and Supply	0	3
		14	14

School of Mining Engineering

Head of School
Professor F. F. Roxborough

Administrative Assistant
Mr W. C. Huisman

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 front-line 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 (pass or honours) 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 Minerals Engineering.

Part-time courses are conducted at the W. S. & L. B. Robinson University College, Broken Hill — in Mining Engineering leading to the award of the BSc(Eng) or BE degree and in Mineral Processing leading to the award of the BSc(Tech) degree. It is also possible to take the BE degree course at Broken Hill as a full-time student.

After graduation, the 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 Department 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 University of Newcastle and the University of Wollongong 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.

3140
Mining Engineering — Full-time Course
Bachelor of Engineering
BE

The first year of the course is essentially the same as that for several other Engineering courses and second year includes those subjects of common relevance to the Engineering disciplines. The third year is largely devoted to basic mining subjects and the fourth year 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 I (ME)	0	6
5.010	Engineering A	6	0
5.020	Engineering B	0	6
5.030	Engineering C†	6	0
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

4.972	Materials for Mining Engineers	1½	1½
5.611	Fluid Mechanics and Thermodynamics	4	4
6.851	Electronics and Instrumentation	3	0
6.852	Electrical Machinery and Supply	0	3
7.112	Mineral Resources	1	0
7.122	Mine Development†	0	1
8.172	Mechanics of Solids II	4	0
8.250	Properties of Materials	2	2
10.022	Engineering Mathematics II	4	4
25.520	Geology for Mining Engineers‡	2	2
10.301	Statistics SA	1½	1½
29.441	Surveying for Engineers	0	6
	General Studies Elective	1½	1½
29.491	Survey Camp	0	0
		24½	26½

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

Year 3

		Hours per week S1	S2
7.113	Mining Methods†	2	2
7.123	Geomechanics	3	3
7.133	Mine Transport	0	2½
7.143	Mine Environment and Safety Engineering‡	2½	2½
7.153	Power Supply in Mines	0	2½
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
25.521	Geology for Mining Engineers II§	4	4
	General Studies Elective	1½	1½
		22	25

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

Year 4

4.974	Mining Materials	1	0
7.114	Geotechnical Engineering	3	3
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
	General Studies Elective	3	3

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

3.301	Fuel Engineering	3	3
4.374	Metal Extraction Processes	3	3
7.124	Coal Face Mechanization*	3	3
7.134	Metalliferous Mining Systems*	3	3
7.314	Mineral Process Technology	3	3
7.144	Surface and Offshore Mining	3	3
7.154	Petroleum Engineering	3	3
7.164	Tunnel Engineering	3	3
		27	27

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

4200 and 4210
Mining Engineering — Part-time Courses
W. S. and L. B. Robinson University College, Broken Hill

The School of Mining Engineering offers two part-time courses in Mining Engineering at Broken Hill. One course is presented as a seven-stage enrolment and there is provision for acceleration by a combination of full and part-time study. Exceptional students may be given permission to increase their part-time enrolment to fifteen hours per week and may finish their course in six stages.

The second course is based on a selection of appropriate subjects from the seven-stage course and may be completed in six stages.

A minimum of three years' concurrent industrial training in approved industries is required before graduation for both courses 4200 and 4210.

4200
Mining Engineering — Seven Stage Part-time Course
Bachelor of Engineering
BE

Stage 1

		Hours per week S1	S2
2.121	Chemistry IA	6	0
5.030	Engineering C	0	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
7.112R	Mineral Resources	1	0
		13	12

Note: Not all options are offered in Engineering A, B and C. Subject to enrolments in any one year it may be necessary to teach 2.121 Chemistry IA and 2.131 Chemistry IB and substitute 5.031R for 5.010 and 5.020 in Stage 2.

Stage 2

1.001	Physics I	6	6
5.010	Engineering A	6	0
5.020	Engineering B	0	6
7.122R	Mine Development	0	1
		12	13

Stage 3

7.113R	Mining Methods	3	3
8.172	Mechanics of Solids	2	2
8.250	Properties of Materials	2	2
10.022	Engineering Maths II	4	4
	General Studies Elective	1½	1½
		12½	12½

Stage 4

		Hours per week S1	S2
6.851	Electronics and Instrumentation	3	0
6.852	Electrical Machinery and Supply	0	3
5.611	Fluid Mechanics/ Thermodynamics	4	4
10.351	Statistics SM	1½	1½
25.520	Geology for Mining Engineers I*	2	2
29.441	Surveying for Engineers	3	3
29.491	Survey Camp†	(40 class contact hours)	
		13½	13½

*Excursions will be necessary.
†Candidates with sufficient practical experience in a mine survey office may be excused from the camp.

Stage 5

7.123R	Geomechanics	3	3
7.133R	Mine Transport	0	2½
7.153R	Power Supply in Mines	2½	0
7.163R	Excavation Engineering	1½	1½
7.213R	Mine Surveying	1	1
7.224R	Operational Management	1½	1½
25.112R	Geology for Mining Engineers IIA	2	2
	General Studies Elective	1½	1½
		13	13

Note: A mining excursion of one week is necessary in either Stage 5 or 6.

Stage 6

7.114R	Geotechnical Engineering	2	2
7.143R	Mine Environment and Safety Engineering	2½	2½
7.313R	Mineral Processing	5	5
25.122R	Geology for Mining Engineers IIB	2	2
	General Studies Elective	1½	1½
		13	13

Stage 7

4.972R	Materials for Mining Engineers	1½	1½
7.214R	Mine Economics and Planning	3	3
7.424R	Feasibility Studies and Seminars	2	2
7.414R	Minerals Industry Project	4	4
	General Studies Elective	1½	1½
		12	12

4210
Mining Engineering — Six Stage Part-time Course

Bachelor of Science (Engineering) BSc(Eng)

Stage 1

		Hours per week S1	S2
2.121	Chemistry IA	6	0
5.030	Engineering C	0	6
10.001	Mathematics I	6	6
7.112R	Mineral Resources	1	0
		13	12

Note: Not all options are offered in Engineering A, B and C. Subject to enrolments in any one year it may be necessary to teach 2.121 and 2.131 Chemistry IA and IB, and to substitute 5.031R for 5.010 and 5.020 in Stage 2.

Stage 2

1.001	Physics I	6	6
5.010	Engineering A	6	0
5.020	Engineering B	0	6
7.122R	Mine Development	0	1
		12	13

Stage 3

7.113R	Mining Methods	3	3
8.172	Mechanics of Solids	2	2
8.250	Properties of Materials	2	2
10.022	Engineering Maths II	4	4
	General Studies Elective	1½	1½
		12½	12½

Stage 4

6.851	Electronics and Instrumentation	3	0
6.852	Electrical Machinery and Supply	0	3
5.611	Fluid Mechanics/ Thermodynamics	4	4
10.351	Statistics SM	1½	1½
25.520	Geology for Mining Engineers I*	2	2
29.441	Surveying for Engineers	3	3
29.491	Survey Camp†	(40 class contact hours)	
		13½	13½

*Excursions are necessary.
†Candidates with sufficient practical experience in a mine survey office may be excused from the camp.

Stage 5

		Hours per week S1	S2
7.125R	Introduction to Geotechnical Engineering	2	0
7.133R	Mine Transport	0	2½
7.153R	Power Supply in Mines	2½	0
7.163R	Excavation Engineering	1½	1½
7.213R	Mine Surveying	1	1
7.224R	Operational Management	1½	1½
25.112R	Geology for Mining Engineers IIA	2	2
	Two General Studies Electives	3	3
		13½	11½

Note: A mining excursion of one week is necessary in either Stage 5 or Stage 6.

Stage 6

7.114R	Geotechnical Engineering	2	2
7.143R	Mine Environment and Safety Engineering	2½	2½
7.313R	Mineral Processing	5	5
25.122R	Geology for Mining Engineers IIB	2	2
7.416R	Minerals Industry Project	2	2
		13½	13½

4190
Mining Engineering — Full-time Program

W. S. and L. B. Robinson University College, Broken Hill

Bachelor of Engineering
BE

Year 1

Stages 1 and 2 of Course No. 4200 combined.

Year 2

Stages 3 and 4 of Course No. 4200 combined. Mine visits are necessary in conjunction with subject 7.113R Mining Methods.

Year 3 and Year 4

Consists of Stages 5, 6 and 7 of Course No. 4200, *plus*,
in Year 3 — Subject No. 7.193R Mine Technology, and
in Year 4 — Subject No. 7.194R Mine Design Practice.
In addition at least 100 days of practical experience must be gained before graduation.

4220
Mineral Processing — Part-time Course

W. S. and L. B. Robinson University College, Broken Hill

Bachelor of Science (Technology)
BSc(Tech)

This course is designed to meet the requirements of students who are employed by the mineral processing industries. It extends over six part-time years of study and leads to the award of the degree of Bachelor of Science (Technology). A minimum of three years' concurrent industrial training in approved industries is required before graduation.

Stage 1

		Hours per week S1	S2
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
10.001	Mathematics I	6	6
7.112R	Mineral Resources	1	0
		13	12

Stage 2

1.001	Physics I	6	6
5.031R	Engineering I	6	6
		12	12

Stage 3

4.972	Materials for Mining Engineers	1	1
7.113R	Mining Methods	3	3
8.172	Mechanics of Solids	2	2
8.250	Properties of Materials	2	2
10.022	Engineering Maths II	4	4
25.520	Geology for Engineers I	2	2
		14	14

Stage 4

2.002A	Physical Chemistry	3	3
2.042C	Inorganic Chemistry	6	0
2.002D	Analytical Chemistry	0	6
5.324	Automatic Control Engineering	3	3
25.201R	Mineragraphic Laboratory Work	1	0
	General Studies Elective	1½	1½
		14½	13½

Stage 5

		Hours per week S1	S2
6.851/2	Electrical Engineering	3	3
5.611	Fluid Mechanics/ Thermodynamics	4	4
10.331	Statistics SS	2	2
7.313R	Mineral Processing	5	5
		14	14

Stage 6

7.153R	Power Supply in Mines	2½	0
7.224R	Operational Management	1½	1½
7.314R	Mineral Process Technology	3	3
7.414R	Mineral Industry Project	4	4
	Two General Studies Electives	3	3
		14	11½

School of Textile Technology

Head of School
Professor M. Chaikin

Senior Administrative Officer
Mr J. Gerstel

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

3170
Textile Technology — Full-time Course

Bachelor of Science
BSc

Year 1 (All courses)

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

Textile Chemistry

Year 2

		Hours per week
2.002A	Physical Chemistry	9
2.002B	Organic Chemistry	
2.002D	Analytical Chemistry	
10.031	Mathematics	2
10.301	Statistics SA	2
13.111	Textile Technology I	8
13.211	Textile Science I	3
	General Studies Elective	1½
		25½

Year 3

		Hours per week
2.003B	Organic Chemistry	
2.003H	Molecular Spectroscopy and Structure	6
13.112	Textile Technology II	12
13.212	Textile Science II	2
13.311	Textile Engineering I	1
	Two General Studies Electives	3
		24

Textile Physics

Year 2

		S1	S2
1.012	Mechanics and Thermal Physics	5	0
1.022	Electromagnetism and Modern Physics	0	5
1.032	Laboratory	3	3
10.1113	Multivariable Calculus *and*	2½	0
10.1114	Complex Analysis *or*	0	2½
10.1213	Multivariable Calculus *and*	2½	0
10.1214	Complex Analysis	0	2½
10.2111	Vector Calculus *and*	2½	0
10.2112	Mathematical Methods for Differential Equations *or*	0	2½
10.2211	Vector Analysis *and*	2½	0
10.2212	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	1½	1½
		27½	27½

Year 3

		S1	S2
1.013	Quantum Mechanics and Nuclear Physics	2	2
1.023	Statistical Mechanics and Solid State Physics	4	0
1.033	Electromagnetism and Optical Physics	0	4
13.112	Textile Technology II	12	12
13.212	Textile Science II	2	2
13.311	Textile Engineering I	1	1
	Two General Studies Electives	3	3
		24	24

Textile Engineering

Year 2

		Hours per week S1	S2
5.330	Engineering Dynamics	2	2
5.6111	Fluid Mechanics	2	2
8.112	Materials and 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	1½	1½
		25½	22½

Year 3

5.111	Mechanical Engineering Design	4	4
5.331	Dynamics of Machines I	2	2
6.851	Electronics and Instrumentation	3	0
6.852	Electrical Machinery and Supply	0	3
13.112	Textile Technology II	12	12
13.212	Textile Science II	2	2
13.311	Textile Engineering I	1	1
	Two General Studies Electives	3	3
		27	27

Textile Manufacture

Year 2

		S1	S2
10.301	Statistics SA	2	2
13.111	Textile Technology I	6	10
13.211	Textile Science I	3	3
14.501	Accounting and Financial Management IA	4	0
14.511	Accounting and Financial Management IB	0	4
15.001	Economics IA	4	0
15.011	Economics IB	0	4
15.501	Introductino to Industrial Relations	3	0
	General Studies Elective	1½	1½
		23½	24½

Year 3

		Hpw
13.112	Textile Technology II	12
13.212	Textile Science II	2
13.311	Textile Engineering I	1
14.081	Introduction to Financial Analysis	2

		Hours per week
28.012	Marketing Systems	
28.022	Marketing Models	4
	Two General Studies Electives*	3
		24

*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 Advanced Elective	1½
		22½

*Optional Subjects

13.223	Advanced Textile Chemistry
13.233	Advanced Textile Physics
13.313	Advanced Textile Engineering
14.602	Information Systems

School of Wool and Pastoral Sciences

Head of School
Associate Professor J. P. Kennedy

Administrative Assistant
Mr J. E. Lawrence

Wool and Pastoral Sciences is concerned with the productivity of the pastoral industries and the quality and marketing of the products of these industries. The School of Wool and Pastoral Sciences offers a full-time course of four year's duration leading to the award of a Bachelor of Science.

The aims of the course are to provide opportunities for students to prepare themselves for careers in research, extension, education, marketing, management and administration in those institutions, corporations, government departments, firms and farms which are involved with pastoral production in Australia and overseas.

The course consists of education in the theory and application of scientific, economic and business management principles which are relevant in: the production and utilization of pastures; the reproduction, nutrition, health, genetic improvement, ecology and management of sheep and cattle; the production, preparation for sale, measurement, specification and marketing of wool and meat animals; communication with the scientific, producer and marketing communities which are involved with the pastoral industries; and, the design and interpretation of experimental investigations.

There are similarities with courses in Agriculture and Rural Science, however special features of Wool and Pastoral Sciences are the education in Wool Science and the concentration on Australia's largest animal industries (sheep and cattle). Graduates of the course are eligible for corporate membership of the Australian Institute of Agricultural Science.

At the graduate level the School 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 undertaken 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.

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	0
10.001	Mathematics I *or*		
10.011	Higher Mathematics I *or*	6	6
10.021B	General Mathematics IB *and*	6	0
10.021C	General Mathematics IC	0	6
17.021	Biology of Higher Organisms	0	6
27.001	Applied Physical Geography*	6	6
		24	24

*Students may with the approval of the Head of the School substitute 1.011 Higher Physics I or 1.001 Physics I or 1.021 Introductory Physics for 27.001 Applied Physical Geography.

Year 2

9.111	Livestock Production I*	3	3
9.201	Agronomy	4	4
9.411	Agricultural Chemistry I	4	4
9.501	Wool Science I	7	7
9.601	Animal Physiology I	0	6
45.101	Biometry	6	0
	General Studies Elective	1½	1½
		25½	25½

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

Year 3

9.131	Animal Health I	0	3
9.202	Pastoral Agronomy	3	3
9.301	Agricultural Economics and Management I	2	4
9.421	Animal Nutrition	0	4
9.801	Genetics I	2	3
41.101	Biochemistry	12	0
	Two General Studies Electives	3	3
		22	20

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

		Hpw S1	S2
9.001	Project	6	6
9.002	Seminar	1	1
	General Studies Elective	1½	1½

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

		Hpw 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

		Hpw S1	S2
9.112	Livestock Production II	3	0
9.203	Crop Agronomy†	0	3
9.302	Agricultural Economy 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
28.022	Marketing Models	0	4
41.111	Biochemical Control	0	6
43.121	Plant Physiology	0	6
43.142	Ecology and Environmental Botany	6	0
44.101	Introductory Microbiology	6	0

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

Table of Progression in Subjects

Year 1		Year 2		Year 3		Year 4	
27.001	Geography I	9.201	*Agronomy*	9.202	*Pastoral Agronomy*	9.203 43.121 43.142	Crop Agronomy Plant Physiology Environmental Botany
9.101	*Biology of Grazing Sheep and Cattle*	9.601	*Animal Physiology I*			9.602	Animal Physiology II
17.021	*Biology of Higher Organisms*	9.111	*Livestock Production I*	9.112 9.421 9.131	L'stock Prodn. II *Animal Nutrition* *Animal Health I*	9.113 9.132	L'stock Prodn. III Animal Health II
2.121 2.131	*Chemistry IA* *Chemistry IB*	9.411	*Agricultural Chemistry I*	41.101	*Biochemistry*	9.412	Agricultural Chemistry II
10.001 10.011 10.021B *and* 10.021C	*Mathematics I*	45.101	*Biometry*	9.801	*Genetics I*	9.811 9.812 9.802	Biostatistics I Biostatistics II Genetics II
				9.301	*Agricultural Economics & Management I*	9.302 9.901	Agric. Economics & Management II Rural Extension
		9.501	*Wool Science I*	9.502	Wool Science II	9.503	Wool Science III

Note: 1. Students may take either Geography I or Physics I.
2. Subjects in italics are compulsory.

3210
Wool and Pastoral Sciences — (Education Option) — Full-time Course*

Bachelor of Science
BSc

*This course will not be offered after 1980.

Year 1

		Hours per week S1	S2
1.001	Physics I *or*	6	6
1.011	Higher Physics I	6	6
2.121	Chemistry IA	6	0
2.131	Chemistry IB	0	6
9.101	Biology of Grazing Sheep and Cattle	6	0
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
17.021	Biology of Higher Organisms	6	0
		24	24

Year 2

		Hpw
9.111	Livestock Production I	3
9.201	Agronomy	4
9.411	Agricultural Chemistry I	4
9.501	Wool Science I	7
9.601	Animal Physiology I*	6
58.512	Introduction to Education	3
	General Studies Elective	1½
		28½

*Session 2

Year 3

		Hpw S1	S2
9.112	Livestock Production II	3	0
9.131	Animal Health I	0	3
9.202	Pastoral Agronomy	3	3

		Hpw S1	S2
9.301	Agricultural Economics I	2	4
9.502	Wool Science II	3	3
9.801	Genetics I	2	3
58.513	Education IA	5	4
58.061	Methods of Teaching*	3	3
	Two General Studies Electives	3	3
		24	26

*Teaching Practice is arranged by the School of Wool and Pastoral Sciences over 3 hours each week which will be additional to the hours shown. Part of this requirement may be met outside University sessions.

Year 4

		Hpw S1	S2
9.113	Livestock Production III	3	3
9.203	Crop Agronomy	0	3
9.302	Agricultural Economics II	3	3
9.421	Animal Nutrition	0	4
43.121	Plant Physiology	0	6
44.111	Microbiology	3	3
58.062	Methods of Teaching*	3	3
58.514	Education IIA	4	4
58.063	Seminar and Thesis on Educational Issues	2	2
	General Studies Elective	1½	1½
		19½	28½

*Teaching Practice is arranged by the School of Wool and Pastoral Sciences over 3 hours each week which will be additional to the hours shown. Part of this requirement may be met outside University sessions.

Graduate Study

Graduate Enrolment Procedures

All students enrolling in graduate courses should obtain a copy of the free booklet *Enrolment Procedures 1980* 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 and Master of Applied Science. 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.

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 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 Graduate Diplomas are available at Kensington only. Candidates may register for all the research degrees at Kensington and for the degrees of Master of Science and Master of Engineering at the W. S. and L. B. Robinson University College, Broken Hill, 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.

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 25.402G Hydrogeology, 25.404G Environmental Geology, or 25.408G Engineering Geology. In special cases, eg where students have achieved a satisfactory standard in Geomechanics, those students taking 25.408G Engineering Geology and/or 25.409G Foundation Geology, may select in place of 25.406G *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			
25.403G	Project (Engineering Geology Graduate Course)	0	18
Group B			
25.402G	Hydrogeology	3	0
25.404G	Environmental Geology	3	0
25.405G	Engineering Geophysics	3	0
25.406G	Geological Basis of Geomechanics	3	0
25.407G	Geopollution Management	3	0
25.408G	Engineering Geology	3	0
25.409G	Foundation Geology	3	0
25.410G	Coastal Environmental Geology	3	0
27.904G	Geomorphology for Engineering Geologists	3	0

8070
Applied Geophysics Graduate Course

Master of Applied Science
MAppSc

The Master of Applied Science degree course in Applied Geophysics is designed to meet the principal needs and the changing demands of the exploration industry, and the continuing rapid development in the scope, sophistication, application and geological interpretation of geophysical methods.

Students may be admitted to the MAppSc degree course in Applied Geophysics provided that they are four-year graduates in Science, Applied Science or Engineering, or have an equivalent qualification, and provided further that they have reached a second year level in Physics and Mathematics and a first year level in Geology.

The duration of the proposed course is one academic year of full-time study, and consists of:

25.331G Applied Geophysics I
25.333G Applied Geophysics IIA
25.335G Applied Geophysics Project

Fifteen days' field tutorials and seminars are an integral part of the course.

8090
Mineral Exploration Graduate Course

Master of Applied Science
MAppSc

The course in mineral exploration has been designed to give specialized training to geologists, geophysicists, geochemists and mining engineers in modern methods of exploration for metallic mineral deposits. The course consists of eight subjects and a project. A wide choice of subjects is available to suit the interests and background of the student. The subjects are:

4.121	Principles of Metal Extraction
7.001G	Exploratory Drilling
7.013	Principles of Mining
7.023	Mineral Process Engineering
25.000G	Special Laboratory Project
25.033	Geology IIIC (Mathematical Geology component only)
25.141	Advanced Engineering Geology *or*
25.337G	Geophysical Procedures
25.338G	Computer Applications in Exploration Geology
25.339G	Geology in Exploration
25.340G	Geochemical Prospecting
25.341G	Remote Sensing
25.343G	Mineral Economics, Leasing Law and Management
25.344G	Field and Laboratory Methods in Exploration
25.345G	Project

School of Chemical Engineering

Formal courses in the School of Chemical Engineering lead to the award of the Master of Applied Science or the Graduate Diploma.

Master of Applied Science Degree Courses

The MAppSc courses involve a project, 3.900G, 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 candidates. Candidates may specialize in the following areas:

8000 Bioprocess Engineering
8010 Chemical Engineering
8040 Environmental Pollution Control
8060 Fuel Technology
and
8080 Industrial Pollution Control

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, namely: Chemical Engineering, Environmental and Industrial Pollution Control, Fuel Technology, and Bioprocess Engineering.

The courses specializing in Chemical Engineering, Industrial Pollution Control 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.

An acceptable course is a program of formal study aggregating approximately twenty hours weekly for two sessions full-time or ten hours weekly for four sessions part-time, comprising:

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

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

3. Undergraduate material (generally designated as subjects without a suffixed G number), which may be included in one or both strands but may not exceed 25% of the total program.

Approximately 60% of the program (including the project) must be undertaken in the School of Chemical Engineering. 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 unitized 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
3.281G	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
3.282G	Microbial Kinetics and Energetics			
	Unit 1 Microbial Kinetics	1		1
	Unit 2 Microbial Energetics	2		2
3.283G	Bioprocess Unit Operations and Equipment Design	3		2
3.284G	Heat, Mass and Momentum Transport	1		1
3.285G	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

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

interests in Biochemistry, Chemistry and/or Microbiology. Graduates with an inadequate background in Mathematics and/or rate processes will be 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 maybe modified to suit individual interests within the general requirements for the MAppSc degree course described above.

Applied Science Graduate or equivalent

Core Material

		Hours per week
3.281G	Unit 3 Design of Microbial Reactors	1
3.282G	Microbial Kinetics and Energetics	3
3.283G	Bioprocess Unit Operations and Equipment Design	2½
3.285G	Bioprocess Laboratory	1½
3.900G	Project	6

Plus 6 hours of other material, for example:

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

42.211G	Principles of Biology	1½
42.212G	Principles of Biochemistry	1½
44.111	Microbiology	3

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

44.111	Microbiology	3
3.281G	Unit 2 — Fundamentals of Microbial Stoichiometry	½
	plus other elective material	3

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

Core Material

		Hours per week
3.281G	Unit 1 Rate Processes	½
	Unit 3 Design of Microbial Reactors	1
3.282G	Microbial Kinetics and Energetics	3
3.283G	Bioprocess Unit Operations and Equipment Design	2½
3.284G	Heat, Mass and Momentum Transport	1
3.900G	Project	6

Plus 6 hours of other material, for example:

		Hpw
3.163G	Industrial Water and Wastewater Engineering	2
38.159G	Treatment and Utilization of Biological Effluents	½
3.396G	Unit Operations in Waste Management	1½
	Reading List (Mathematics)	1

8010
Chemical Engineering Graduate Course*

Master of Applied Science
MAppSc

The graduate course in Chemical Engineering provides an opportunity, primarily for graduates in Chemical Engineering, to continue first degree formal studies into topics to a depth not found in an undergraduate course. It also provides an opportunity for graduates of some experience to periodically undertake advanced or refresher courses.

8040
Environmental Pollution Control Graduate Course*

Master of Applied Science
MAppSc

The graduate course in Environmental Pollution Control leads to the award of the degree of Master of Applied Science. It extends over one full-time year or two part-time years. The course is primarily intended for candidates who have completed a four year Bachelor degree program in Chemical Engineering or Industrial Chemistry, but candidates from other disciplines may be admitted.

The advent of new laws governing the disposal of effluents into the environment will make the problems of industry more acute as industrial processes are developed and expanded. This course is intended to cover the problems in environmental engineering which may be encountered in industrial plants.

*For additional information on the MAppSc degree course see page 56.

		Hours per week
1.		
3.170G	Process Principles or Graduate Elective	2
2.		
3.162G	Urban Planning	½
3.164G	Medical Aspects	½
3.166G	Legislative Aspects	½
27.902G	Meteorological and Hydrological Principles	1
44.111	Microbiology	3
3.		
3.163G	Industrial Water and Wastewater Engineering	2
3.381G	Atmospheric Pollution and Control	2
3.386G	Unit Operations in Waste Management	1½
39.908G	Community Noise Control	1
38.159G	Treatment and Utilization of Biological Effluents	½
	Optional Elective(s) *and*	3
3.901G	Minor Project *or*	3
3.900G	Project	6

3.170G Process Principles is a bridging subject for all candidates other than Chemical Engineering and Industrial Chemistry graduates. Candidates who have passed the equivalent of first year Chemistry take 3.170G Process Principles, and those who have passed the equivalent of second year Chemistry may take speficied parts of 3.170G Process Principles and an approved graduate elective each for one hour per week. Graduates in Chemical Engineering or Industrial Chemistry take an approved elective.

All electives must be approved by the Head of the School but applications will be considered regarding any subject available in the University which has a relevance to Pollution Control.

Students intending to undertake the course over two part-time years may do so by attending on one afternoon and two evenings per week. Every effort should be made to include in the first part-time year the subjects listed in **1.** and **2.** above.

The work involved in 3.901G Minor Project must be embodied in a report and submitted in accordance with the requirements of the School.

8060
Fuel Technology Graduate Course*

Master of Applied Science
MAppSc

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 3.311 and 3.321 can comprise the 25% undergraduate component, the project (15 or 30% of the program) is 3.900G, and the remainder of the hours can be taken from the units offered in the 3.38-G series of subjects. There are also compulsory seminar and laboratory practice subjects.

The course allows reasonable flexibility with a choice of subjects, and units within subjects, subject to the availability of staff.

Provision is made for subjects outside those offered by the Department to be incorporated in the program at either graduate or undergraduate level.

8080
Industrial Pollution Control Graduate Course*

Master of Applied Science
MAppSc

This course is intended for graduates who wish to undertake further studies in environmental topics of a more specialized nature than the class of subjects offered in course **8040**. For this reason applicants will normally have undertaken a first degree in an area of application to industrial processes.

Candidates design their proposed programs of study on the basis of subjects available in the **8040** course in a chosen specialized field. Supplementary supporting subjects, as may be available, are taken subject to the general rules above for acceptable formal study programs. In the design of their course candidates are expected to have an objective of contributing to the relief of industrial pollution problems.

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

*For additional information on the MAppSc degree course see page 56.

to the graduate level of certain subjects. For this purpose the subject, 3.170G Process Principles, is specified.

The first year of the course introduces elementary aspects of corrosion technology and suitably orientates students depending on their initial qualifications. The second year of the course contains more detailed instruction at a graduate level in corrosion theory and prevention, together with suitable laboratory assignments.

Year 1

		Hours per week
3.170G	Process Principles *or*	2
3.172G	Corrosion Laboratory	2
3.171G	Corrosion Technology I	3
		5

Chemical Engineering graduates will undertake:
3.172G Corrosion Laboratory

Science Graduates who have passed the equivalent of second year Chemistry will undertake parts of:
3.170G Process Principles (1 hr/wk)
3.172G Corrosion Laboratory (1 hr/wk)

Graduates who have passed only the equivalent of first year Chemistry will undertake 3.170G Process Principles.

Year 2

		Hpw
3.173G	Corrosion Materials	2
3.174G	Corrosion Technology II	3
3.175G	Seminar	1
3.176G	Corrosion Literature Review	2†
3.177G	Testing Laboratory (by roster)	2†
		10

School of Chemical Technology

8005
Chemical Technology Graduate Course
Master of Applied Science
MAppSc

The aim of this course is not to produce narrow specialists but to train graduates to identify and solve a wide range of problems in those areas of the chemical industry concerned with the production and development of inorganic chemicals, organic chemicals, surface coatings, plastics, elastomers, or ceramic materials. The method is student participation in formal courses and projects of a collaborative kind.

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 Chemical Technology. The remainder, subject to approval and availability, may be undertaken in other schools within the university.

Graduate subjects in Chemical Technology may be selected from:

		Hours per week
22.110G	Process Evaluation	3*
22.120G	Machine Computation in Chemical Technology	6
22.130G	Chemical Reactor Analysis and Control	6
22.131G	Catalysis and Applied Reaction Kinetics	6
22.140G	Chemical Process Simulation	6
22.141G	Modelling in Chemical Technology	6
22.142G	Chemical Process Control	6
22.150G	Instrumental Analysis for Industry	3*
22.160G	Industrial Electrochemistry	6
22.161G	Electrochemical Techniques for Control and Analysis	6
22.210G	Solid State and Mineral Chemistry	2*
22.220G	Refractory Technology I	6
22.221G	Refractory Technology II	6
22.230G	Chemistry of Glass Melting	6
22.300G	Polymer Science	10
22.310G	Analytical Characterization of Polymers	8
22.330G	Polymer Engineering	6
22.340G	Polymer Physics	6
22.900G	Major Project	6*
22.901G	Minor Project	3*

†This is the weekly equivalent of total hours for the subject. These hours may, however, be concentrated in one period.
*These subjects operate for *two* sessions at the stated hours per week.

The work involved in the project must be embodied in a report and submitted in accordance with the requirements of 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 given subject may not necessarily be conducted in any one year.

School of Food Technology

The School of Food Technology conducts formal courses leading to the award of the Master of Applied Science degree 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 sholarships, 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. It is a course 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 Chemical Technology may be selected from:

		Hours per week*
38.151G	Introductory Food Science	1
38.152G	Food Process Laboratory	3
38.153G	Food Technology Seminar	1
38.154G	Food Technology	6
38.155G	Dairy Technology	2
38.156G	Oenology	1
38.157G	Technology of Cereal Products	1
38.158G	Marine Products	1
38.160G	Food Quality Assessment	1
38.161G	Food Additives and Toxicology	1
38.162G	Postharvest Physiology and Handling of Fruit and Vegetables	3
38.351G	The Microbial Ecology of Foods	3
38.551G	Advanced Nutrition	1½
38.552G	Methods in Food and Nutritional Education	1½
38.553G	Methods in Nutritional Assessment and Analysis	1½
39.900G	Major Project	6
38.901G	Minor Project	3

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.

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

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 Applied Science in Food Technology (GradDip) is awarded on the successful completion of one year of full-time study (18 hours/week), or two years of part-time study (9 hours/week). It involves the following program:

		Hours per week*
38.151G	Introductory Food Science	1
38.152G	Food Process Laboratory	3
38.153G	Food Technology Seminar	1
38.154G	Food Technology	6
	Electives†	7

†Electives are to be selected from the following list of subjects according to availability and with the approval of the Head of School.

		Hours per week
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
38.342	Yeast Technology	1½
38.431	Food Engineering I	3
38.442	Food Engineering II	3
38.542	Special Topics in Nutrition	1½
38.551G	Advanced Nutrition	1½
38.552G	Methods of Nutritional Assessment and Analysis	1½
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
44.111	Microbiology	3
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 Metallurgy who are interested in doing research in metallurgy leading to the award of the degrees of Master of Science, Master of Engineering or Doctor of Philosophy.

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 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.

*Weekly equivalent of total hours for subject. These hours may be concentrated in one session.

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

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

Undergraduate Subjects

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

The School offers a graduate course leading to the award of a Graduate Diploma (GradDip).

5040
Mining and Mineral Engineering Graduate Diploma Course
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 the beneficiation of minerals or the preparation of coal.

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	0	2
7.311G	Mineral Beneficiation	0	3
7.111G	Mining Engineering	0	3
		5	8

Year 2 — Part-time

7.122G	Mining Engineering Technology *or*	6	0
7.322G	Mineral Beneficiation Technology	6	0
7.132G	Mining Engineering Laboratory and Project *or*	0	6
7.332G	Mineral Engineering Laboratory	0	6
		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.

Full-time Course

	Hours per week
At least 10 hours per week chosen from:	
9.105G Livestock Production	6
9.504G Wool Science	6
9.803G Animal Breeding	4
9.813G Quantitative Methods	4

Plus a maximum of 8 hours per week of study of approved undergraduate subjects.

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

School of Wool and Pastoral Sciences

5080
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 carryout full-time study or its equivalent of two optional graduate level subjects to the extent of ten hours lecture and laboratory work per week for two sessions plus approved undergraduate subjects to the extent of eight hours 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.

School of Mechanical and Industrial Engineering

5450
Industrial Engineering Graduate Diploma Course

Graduate Diploma
GradDip

Students who have graduated from schools of the Faculty of Applied Science and who wish to continue their studies in the field of scientific management, may enrol in the Graduate Diploma course in Industrial Engineering offered by the School of Mechanical and Industrial Engineering.

This course provides instruction in accountancy, economics, industrial law, economic analysis, the use of human and physical resources, organization and administration, operations research and production control.

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: Faculty Table (Graduate Study)** in the Calendar.

For the statements **Preparations and Submissions of Project Reports and Theses for Higher Degrees** *and* **Policy with respect to the use of Higher Degree Theses** see the Calendar.

	Title	Abbreviation	Calendar/Handbook
Higher Degrees	Doctor of Science	DSc	Calendar
	Doctor of Letters	DLitt	Calendar
	Doctor of Laws	LLD	Calendar
	Doctor of Medicine in the Faculty of Medicine	MD	Calendar Medicine
	Doctor of Philosophy	PhD	Calendar and all faculties
	Master of Applied Science	**MAppSc**	**Applied Science**
	Master of Architecture	MArch	Architecture

Title	Abbreviation	Calendar/Handbook
Master of Arts	MA(Hons)	Arts Military Studies
	MA	Arts Military Studies
Master of Biomedical Engineering	MBiomedE	Engineering
Master of Building	MBuild	Architecture
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 General Studies	MGenStud	General Studies
Master of Health Administration	MHA	Professional Studies
Master of Health Personnel Education	MHPEd	Calendar†
Master of Health Planning	MHP	Professional Studies
Master of Landscape Architecture	MLArch	Architecture
Master of Laws by Research	LLM	Law
Master of Librarianship	MLib	Professional Studies
Master of Mathematics	MMath	Sciences*
Master of Optometry	MOptom	Sciences*
Master of Physics	MPhys	Sciences*
Master of Psychology	MPsychol	Sciences‡
Master of Public Administration	MPA	AGSM
Master of Science **Master of Science without Supervision**	**MSc**	**Applied Science** Architecture Engineering Medicine Military Studies Sciences*‡
Master of Science (Acoustics)	MSc(Acoustics)	Architecture
Master of Science and Society	MScSoc	Sciences*
Master of Science (Biotechnology)	MSc(Biotech)	Sciences‡
Master of Science (Building)	MSc(Building)	Architecture
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

	Title	Abbreviation	Calendar/Handbook
	Master of Surveying Science	MSurvSc	Engineering
	Master of Town Planning	MTP	Architecture
Graduate Diplomas	**Graduate Diploma**	**GradDip**	**Applied Science** Architecture Engineering Sciences*‡
		DipFDA	Sciences*
	Graduate Diploma in the Faculty of Professional Studies	DipArchivAdmin DipEd DipLib	Professional Studies

*Faculty of Science.
†Professorial Board.
‡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 recognized 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 judgement 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.

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.

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 600 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.

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

Entry for Examination

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

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.

Master of Applied Science (MAppSc)

1. The degree of Master of Applied Science may be awarded by the Council on the recommendation of the Professorial Board to a candidate who has satisfactorily completed a program of advanced study comprising formal course work and including, where set down in course programs, the submission of a report on a project approved by the Higher Degree Committee of the Faculty or Board of Studies.

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

Qualification for Registration as a Candidate for the Degree

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.

(2) The Higher Degree Committee of the Faculty (hereinafter referred to as 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.

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 six (6) weeks 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, 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 by 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) (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. Consequent upon consideration of the examiners' reports, where appropriate, and the candidate's other results in the prescribed course of study, the Committee shall recommend to the Professorial Board 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 been admitted to the degree of Bachelor in the University of New South Wales, or other approved university, in an appropriate school.

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if he submits evidence of such academic and professional attainment as may be approved by the Professorial Board on the recommendation of 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.

(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 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 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 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 in an appropriate School or Department.

(2) In exceptional cases a person may be permitted to register as a candidate for the degree if he submits evidence of such academic and professional attainments as may be approved by the Professorial Board on the recommendation of 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 in which the candidate is registered a report on the progress of the candidate. The Committee shall review the report and as a result of its review may 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 himself for examination not later than six academic sessions from the date of registration. A candidate not fully engaged in research shall present himself for examination not later than twelve academic sessions from the date of his registration. In special cases an extension of these times may be granted by the Committee.

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 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.

Registration

3. (1) An application to register as an external candidate for the degree of Master of Science, Master of Engineering or Master of Surveying without supervision shall be lodged with the Registrar for recommendation by the Head of School and consideration by the Higher Degree Committee of the appropriate Faculty (hereinafter referred to as the Committee) not less than six months before the intended date of submission of the thesis. A graduate who intends to apply in this way should in his own interest at an early stage, seek the advice of the appropriate School with regard to the adequacy of the subject matter for the degree. A synopsis of the work should be enclosed.

(2) A candidate shall not be considered for the award of the degree until the lapse of six sessions in the case of honours graduates and eight sessions in the case of pass graduates from the date of graduation.

Thesis

4. (1) (a) Every candidate for the degree shall be required to submit three copies of a thesis embodying the results of an investigation or design. 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. A candidate may submit also for examination any work he has published, whether or not such work is related to the thesis.

(b) Every candidate shall submit with the thesis a statutory declaration that the material contained therein is his own work, except where otherwise stated in 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 be an internal examiner.

(3) If the thesis reaches the required standard, the candidate shall be required to attend for an oral examination at a time and place nominated by the Committee. The examiners may also arrange at their discretion for the examination of the candidate by written and/or practical examinations on the subject of the thesis and/or subjects related thereto.

(4) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968 the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

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

Recommendation for Admission to Degree

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

Fees

1. An application for admission to a graduate diploma course shall be made on the prescribed form which should be lodged with the Registrar at least two full calendar months before the commencement of the course.

Graduate Diploma (GradDip)

2. An applicant for admission to a graduate diploma course shall be:

(1) a graduate of the University of New South Wales or other approved university.

(2) a person with other qualifications as may be approved by Faculty.

3. Nothwithstanding clause **2.** above, Faculty may require an applicant to take such other prerequisite or concurrent studies and/or examinations as it may prescribe.

4. Every candidate for a graduate diploma shall be required to undertake the appropriate course of study, to pass any prescribed examinations, and if so laid down in the course, to complete a project or assignment specified by the Head of the School. The format of the report on such project or assignment shall accord with the instructions laid down by the Head of the School.

5. An approved applicant shall be required to pay the fee for the course in which he desires to register. Fees shall be paid in advance.

Subject Descriptions

Identification of Subjects by Number

Each of the subjects taught in the University is identifiable both by number and by name. This is a fail-safe measure at the points of enrolment and examination against a student nominating a subject other than the one intended. Subject numbers are allocated by the Assistant Registrar, Examinations and Student Records, and the system of allocation is:

1. The School offering a subject is indicated by the number before the decimal point;

2. If a subject is offered by a Department within a School, the first number after the decimal point identifies that Department;

3. The position of a subject in a sequence is indicated by the third number after the decimal point. For example, 2 would indicate that the subject is the second in a sequence of subjects;

4. Graduate subjects are indicated by the suffix G.

As indicated above, a subject number is required to identify each subject in which a student is to be enrolled and for which a result is to be returned. Where students may take electives within a subject, they should desirably be enrolled initially in the particular elective, and the subject numbers allotted should clearly indicate the elective. Where it is not possible for a student to decide on an elective when enrolling or re-enrolling, and separate examinations are to be held in the electives, Schools should provide to the Examinations and Student Record Section in April (Session 1) and August (Session 2) the names of students taking each elective. Details of the actual dates in April and August are set out in the Calendar of Dates earlier in this volume.

Those subjects taught in each Faculty are listed in full in the handbook of that Faculty, in the section entitled **Subject Descriptions.**

Details of subjects available in Faculty of Applied Science courses but not included in this list may be obtained from the School responsible for the subject. Details of subjects in the Faculty of Arts which may be taken as humanities subjects may be found in the current Arts Faculty Handbook.

The **identifying numbers** for each School are set out on the following page.

Servicing Subjects are those taught by a School or Department outside its own faculty and are listed at the end of **Undergraduate Study** and **Graduate Study** of the relevant School. Their subject descriptions are published in the handbook of the Faculty in which the subject is taught.

HSC Exam Prerequisites

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

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

Information Key

The following is the key to the information supplied about each subject: S1 (Session 1); S2 (Session 2); F (Session 1 *plus* Session 2, ie full year); S1 or S2 (Session 1 *or* Session 2, ie choice of either session); SS (single session, ie which session taught is not known at time of publication); L (Lecture, followed by hours per week); T (Laboratory/Tutorial, followed by hours per week); hpw (hours per week); C (Credit).

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1	School of Physics*	Science	76
2	School of Chemistry*	Science	77
3	**School of Chemical Engineering**	**Applied Science**	**79**
4	**School of Metallurgy**	**Applied Science**	**89**
5	School of Mechanical and Industrial Engineering*	Engineering	93
6	School of Electrical Engineering*	Engineering	94
7	**School of Mining Engineering**	**Applied Science**	**95**
8	School of Civil Engineering*	Engineering	100
9	**School of Wool and Pastoral Sciences**	**Applied Science**	**100**
10	School of Mathematics*	Science	103
11	School of Architecture*	Architecture	
12	School of Psychology*	Biological Sciences	105
13	**School of Textile Technology**	**Applied Science**	**105**
14	School of Accountancy*	Commerce	107
15	School of Economics*	Commerce	107
16	School of Health Administration	Professional Studies	
17	Biological Sciences*	Biological Sciences	109
18	School of Mechanical and Industrial Engineering (Industrial Engineering)*	Engineering	109
21	Department of Industrial Arts	Architecture	
22	**School of Chemical Technology**	**Applied Science**	**110**
23	School of Nuclear Engineering*	Engineering	115
24	School of Transport and Highways	Engineering	
25	**School of Applied Geology**	**Applied Science**	**115**
26	Department of General Studies	Board of Studies in General Education	
27	**School of Geography**	**Applied Science**	**123**
28	School of Marketing*	Commerce	128
29	School of Surveying*	Engineering	128
30	Department of Organizational Behaviour*	Commerce	129
31	School of Optometry	Science	
32	Centre for Biomedical Engineering	Engineering	
35	School of Building	Architecture	129
36	School of Town Planning*	Architecture	
37	School of Landscape Architecture	Architecture	
38	School of Food Technology	Applied Science	129

	School, Department etc	Faculty	Page
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40	Professorial Board		
41	School of Biochemistry*	Biological Sciences	134
42	School of Biological Technology*	Biological Sciences	135
43	School of Botany*	Biological Sciences	135
44	School of Microbiology*	Biological Sciences	136
45	School of Zoology	Biological Sciences	
50	School of English	Arts	
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52	School of Philosophy	Arts	
53	School of Sociology*	Arts	136
54	School of Political Science	Arts	
55	School of Librarianship	Professional Studies	
56	School of French	Arts	
57	School of Drama	Arts	
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59	School of Russian	Arts	
62	School of History and Philosophy of Science	Arts	
63	School of Social Work	Professional Studies	
64	School of German	Arts	
65	School of Spanish and Latin American Studies	Arts	
66	Subjects Available from Other Universities		
68	Board of Studies in Science and Mathematics	Board of Studies in Science and Mathematics	
70	School of Anatomy	Medicine	
71	School of Medicine	Medicine	
72	School of Pathology	Medicine	
73	School of Physiology and Pharmacology	Medicine	
74	School of Surgery	Medicine	
75	School of Obstetrics and Gynaecology	Medicine	
76	School of Paediatrics	Medicine	
77	School of Psychiatry	Medicine	
79	School of Community Medicine	Medicine	
80	Faculty of Medicine	Medicine	
85	Australian Graduate School of Management	AGSM	
90	Faculty of Law	Law	
97	Division of Postgraduate Extension Studies		

*Offers subjects for courses outlined in this handbook.

School of Physics

Undergraduate Study

Physics Level I units

1.001 Physics I **F L3T3**

Prerequisites:

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

Co-requisites: 10.021C or 10.001 or 10.0011.

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.

A molecular approach to energy transfer, kinetic theory, gas laws and calorimetry. 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. Interaction of radiation with matter, photoelectric effect. Compton effect, spectroscopy. Resolution of the wave-particle paradox by means of wave mechanics and the uncertainty principle.

1.011 Higher Physics I **F L3T3**

Prerequisites:

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

Co-requisite: 10.001 or 10.011

For students of all Faculties except Medicine and Architecture who have a good secondary school record and who wish to do a more challenging course. Entry to this course requires permission from the Head of the School of Physics.

As for 1.001 with additional topics: space physics, mechanical properties of real materials, rotational dynamics, physics of biological systems, AC and charged dynamics, physics of energy resources and conversion.

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

Co-requisites: 10.021A and 10.021B, or 10.021B and 10.021C, or 10.021 or 10.001 or 10.011.

An introductory subject in physics designed principally for students majoring in the life and health science disciplines. Discusses the following 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, altering current, atomic nature of matter, X-rays, the nucleus and radioactivity, electronics, geometrical optics, optical instruments, wave optics, microscopes and their uses.

Physics Level II units

1.012 Mechanics and Thermal Physics **S1 L3T2**

Prerequisites: 1.001 or 1.011, 10.001. Co-requisites: 10.2111.

Properties of solids and liquids, elasticity, hydrostatics, hydrodynamics, damped and forced vibrations, resonance, coupled systems, normal modes, Fourier analysis, waves, group velocity, reflection and transmission at a boundary.

Kinetic theory, Maxwell velocity distribution, transport coefficients, first and second laws of thermodynamics, thermodynamic functions, simple applications, microscopic approach to thermodynamics, Boltzmann probability.

1.022 Electromagnetism and Modern Physics **S2 L3T2**

Prerequisites: 1.001 or 1.011, 10.001. Co-requisites: 10.2111. Excluded: 1.932.

Electrostatics in vacuum and in dielectrics, Gauss' law, current density, magnetostatics in vacuum and in magnetic materials, electromagnetic induction, displacement current, Maxwell's equations, simple solutions, applications.

Special theory of relativity, Lorentz transformation, simultaneity, relativistic mass, momentum and energy, formalism of wave mechanics Schrodinger's equation, simple solutions, hydrogen atom, spectra, electron spin, selection rules, exclusion principle, Zeeman effect molecules.

1.032 Laboratory **F T3**

Prerequisite: 1.001, 1.011, 10.001. Excluded: 1.922

Alternating current circuits, complex impedance, resonance, mutual inductance, introductory electronics, diode 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 1.011 or 1.021, 10.001 or 10.011 or 10.021B and 10.021C.

The application of electronics to other disciplines. Principles of circuit theory and analogue computing; amplifiers, 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, 10.001 or 10.011 or 10.021B and 10.021C. Excluded: 1.022.

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

Physics Level III units

1.013 Quantum Mechanics and Nuclear Physics **F L1½T½**

Prerequisites: 1.012, 1.022, 10.2111, 10.2112.

Concepts and formulation, expectation values and measurement, steps, wells, and barriers, tunnelling, harmonic oscillator, perturbation theory, hydrogen atom, angular momentum operators, spin and spin orbit coupling, vector model, fine structure, identical particles, helium atom, spectroscopy, electron states in molecules and solids.

Detecting instruments for nuclear particles, counting statistics, Rutherford scattering, radioactivity, radiative processes, reactions, optical model, parity, introduction to particle physics, mesons, baryons, quarks.

Additional material is studied for the award of Distinction/High Distinction.

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

Prerequisites: 1.012, 1.022, 10.2111, 10.2112. Co-requisite: 1.013 or 2.023A.

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 model of metals, band theory, point defects, dislocations.

Additional material is studied for the award of Distinction/High Distinction.

1.033 Electromagnetism and Optical Physics S2 L3T1

Prerequisites: 1.012, 1.022, 10.2111, 10.2112.

Wave equation, reflection and transmission at dielectric, metallic and plasma interfaces, Fresnel equations, skin depth, waveguides and cavities, radiation fields, dipole and long antenna.

Fourier theory, diffraction from rectangular and circular apertures, interference and interferometry, coherence, image formation, resolution, holography, Fourier transform spectroscopy.

Additional material is studied for the award of Distinction/High Distinction.

1.043 Experimental Physics A **F T4**

Prerequisites: 1.012, 1.022, 1.032.

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

School of Chemistry

Undergraduate Study

2.002A Physical Chemistry **S1 or S2 L3T3**

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

Thermodynamics: First, second and third laws of thermodynamics; statistical mechanical treatment of thermodynamic properties; applications of thermodynamics; chemical equilibria, phase equlibiria, solutions of non-electrolytes and electrolytes, electrochemical cells.

Kinetics: Order and molecularity; effect of temperature on reaction rates; elementary reaction rate theory.

Surface Chemistry and Colloids: Absorption, properties of dispersions; macromolecules and association colloids.

2.002B Organic Chemistry — S1 or S2 L3T3

Prerequisite: 2.131.

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.

2.002C Inorganic Chemistry — S1 or S2 L2T4

Prerequisites: 2.121 and 2.131.

Chemistry of typical metals; transition metals; introduction to nuclear chemistry. Quantitative inorganic analysis.

2.002D Analytical Chemistry — S1 or S2 L2T4

Prerequisites: 2.121 and 2.131 and 10.011 or 10.001 or 10.021B and 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 stereo-chemical selectivity; transannular reactions in medium rings. Synthesis and reactions of fused and bridged polycyclic systems.

Heterocyclic 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

Prerequisites: 2.121 and 2.131.

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

2.013L Chemistry and Enzymology of Foods — F L1T2

Prerequisite: 2.002B. Excluded: 2.023L, 2.043L, 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.

2.042C Inorganic Chemistry — S1 or S2 L2T4

Prerequisites: 2.121 and 2.131.

Chemistry of the non-metals, including B, C, Si, N, P, S, Se, Te, halogens, and noble gases. 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.

2.043L Chemistry and Enzymology of Foods

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

Syllabus as for 2.013L but in greater detail and depth.

2.111 Introductory Chemistry† — S1 L2T4

Prerequisite: Nil.

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 of 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 Science (any strands)	*31-100*
or	
4 unit Science (multistrand)	*31-100*
or	
Chemistry 2.111.	

Stoichiometry and solution stoichiometry. Structure of matter, solids, liquids, gases. Thermochemistry. Equilibria and equilibrium constants, entropy changes, free energy changes, the relationship between

†Students who have passed 2.121 may not subsequently enrol in 2.111. Students meeting the 2.121 prerequisite are not permitted to enrol in 2.111 without permission of the Head of the School of Chemistry. Once students enrol in 2.111 they must pass 2.111 before proceeding to 2.121 or 2.131.

equilibrium and standard free energy changes. Ideal solutions, colligative properties. Equilibrium in electrolyte solutions, acid-base equilibria, solubility equilibria, and redox equilibria. The rate of a chemical change and chemical kinetics.

2.131 Chemistry IB — S1 or S2 L2T4

Prerequisite: 2.111 or 2.121.

Relative stability of oxidation states. Electronic structure of atoms in terms of the quantum mechanical model. Structure of the Periodic Table and its relationship to electronic configuration. Chemical bonding, hybridization. Properties of compounds of selected elements, acidbase character of oxides and hydroxy compounds. Chemistry of carbon compounds, steroisomerism, reactions of aliphatic and aromatic hydrocarbons, alcohols, phenols, ethers, alkyl halides, aldehydes, ketones, carboxylic acids and their derivatives, esters, acyl halides, anhydrides, amides, amines.

Graduate Study

2.271G Chemistry and Analysis of Foods

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.

Subject matter 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.

School of Chemical Engineering

Undergraduate Study

General

Students are expected to possess a slide rule having exponential (log-log) scales, or a calculator of equivalent capabilities (ln x and exp x or 'x to the y'), and these 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 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.

Department of Chemical Engineering

3.011 Introduction to Chemical Engineering — S2 L½T1½

Application of material and simple energy balances in chemical process operations. Primary reference to the oil, heavy chemical and related process industries with additional examples of the application of chemical engineering technology to identifying and solving problems in areas such as environmental pollution, food technology and medicine.

3.021 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 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.

Unit 3 Material Balances — S1 L1T1

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.

3.022 Chemical Engineering IB

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 Pumps and Pumping — S2 L½T½

Prerequisite: 3.021 Unit 1.

Types of piping and fittings. Blow cases. Air lift pumps. Reciprocating pumps, centrifugal pumps and gear pumps. Blowers and compressors.

Unit 3 Thermodynamics I — S2 L1T1

Prerequisite: 2.002A.

Basic thermodynamic principles leading to the Phase Rule, P-V-T relationships. Energy balances. 2nd Law of Thermodynamics. Entropy.

Unit 4 Computations I — 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 3.021 and 3.022.

3.025 Chemical Engineering for Chemical Technologists

Consists of Units 1 and 2 of 3.021 and Units 1 and 2 of 3.022.

3.031 Chemical Engineering IIA

Unit 1 Mass Transfer (Theory) — S1 L1T1

Prerequisites: 2.002A, 3.021.

Molecular diffusion in gases, liquids and solids and the measurement and calculation of diffusion coefficients. Diffusion at an interface — one component unidirectional diffusion and equimole counterdiffusion under steady state conditions. Mass transfer coefficients. Estimation and application of chemical and phase equilibria. Stage calculations applied to liquid/liquid, vapour/liquid and other mass transfer operations. The two film theory and the transfer unit concept in gas/liquid, vapour/liquid, and other operations.

Unit 2 Heat Transfer II (Theory) — S1 L1

Prerequisite: 3.022, Unit 1. Co-requisite: 10.032.

An extension of the work covered in 3.022 Unit 1, with an emphasis on the fundamentals of conduction, convection and unsteady state heat transfer.

Unit 3 Thermodynamics II — S1 L1T1

Prerequisite: 3.022, Unit 3.

The thermodynamic properties of pure fluids and homogeneous mixtures; an introduction to phase equilibrium; chemical reaction equilibrium.

3.032 Chemical Engineering IIB

Unit 1 Reaction Engineering I — S1 L1

Prerequisites: 2.002A, 10.031.

A course of lectures together with weekly assignments covering the design and analysis of ideal reactor systems, involving single and multiple reactor types, in which simple or complex, single or multiple reactions are effected.

Unit 2 Plant Layout I — 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 & Fittings: fabrication, standards, most used sizes and types. Welded, screwed and bolted connections. Common valve types; their flow and serviceability 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 accessibility for maintenance, operator convenience and safety. Distribution of utility fluids. Methods of erecting major process units.

Unit 3 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 4 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.

Unit 5 Process Report — S1 T1

The process report is a compilation of recent information on a process for the production of a specific chemical or a group of chemicals. The report will cover such aspects as: historical account of the process with process details; Australia's imports and exports of the particular chemical, local production, company ownership and overseas connections; the present state of the process and its future in Australia with particular respect to scale, raw materials and alternative and competing end products and processes.

3.033 Chemical Engineering IIC

Unit 1 Fluid-particle Systems I — S2 L1T1

Prerequisite: 3.021, 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.

Unit 2 Multicomponent Separation — S2 L1

Prerequisites: 3.031 Unit 1, 3.031 Unit 3.

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 3 Thermodynamics III — S2 L1

Prerequisite: 3.031 Unit 3.

Applications of thermodynamics, including power cycles, refrigeration and liquefaction. Thermodynamic analysis of processes.

Unit 4 Solids Handling — S2 L1

Prerequisite: 3.021 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.

3.034 Chemical Engineering IID

Unit 1 Reaction Engineering II — S2 L1T1

Prerequisite: 3.032 Unit 1.

Lectures together with assignments covering the concept of process rate and rate of change of process variables. Differential balances and examples in mass and heat transfer, and reactive systems.

Unit 2 Process Dynamics I — S2 L1

Prerequisite: 10.031.

Classification of system variables. Formulation of mathematical description of simple dynamic systems. Use of Laplace transforms and block diagrams in manipulating linear dynamic equations. Time response of linear systems.

Unit 3 Instrumentation — S2 L1

Elementary treatment of transducers, transmitters and instruments for measuring temperature, pressure, flow, liquid level and pH. Speed of response.

Unit 4 Computations II — S2 T1

Prerequisite: 10.031, 3.022 Unit 4.

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.

3.035 Chemical Engineering IIE

Unit 1 Mass Transfer (Design) — S2 L1T½

Prerequisite: 3.031 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: 3.031 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 Design Report — S2 T1

Prerequisite: 3.032 Unit 3.

The basis of this subject is a design report to test knowledge of principles and design as applied to a possible industrial situation. The report should take the form of a set of iterative calculations and specifications for the components of a simple processing battery and is usually limited in size to a battery consisting of two prinicpal unit operations in series (e.g. extractor and fractionator, reactor and separator, etc.). Particular attention is paid to operating instructions, hazards and safety, economic evaluation, use of standards and general presentation.

3.036 Chemical Engineering Laboratory I

Unit 1 and 2 **S1T2 S2T3**

Prerequisites: 3.021, 3.022, 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 engineeing which are covered in Chemical Engineering IA & B and II A-E, 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.

3.040 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.

3.041 Chemical Engineering IIIA

Prerequisite: 3.031

Unit 1 Convective Mass Transfer **S1 L1**

Models for convective mass transfer at 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 will be discussed.

Unit 3 Surface Separation Processes **S1 L1**

Principles of membrane processes, reverse osmosis, ultrafiltration, dialysis and electrodialysis. Design calculations for batch and continuous operation of reverse osmosis and ultrafiltration equipment. Principles of sorption processes, such as adsorption ion exchange and molecular sieves. Design of fixed-bed sorption equipment. Principles and design of other surface separation processes such as foam and bubble fractionation.

Unit 4 Transport Phenomena **S1 L1**

A generalised 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.

3.042 Chemical Engineering IIIB

Prerequisite: 10.032.

Unit 1 Process Dynamics II **S1 L1**

Prerequisite: 3.034 Unit 2.

Extension of material on linear systems to distributed-parameter cases. Linear frequency response. Experimental characterization of linear systems. The analysis of non-linear systems by linearization and numerical methods. The application of these techniques to particular processes and instruments will be stressed.

Unit 2 Control I **S1 L1T1**

Basic concepts in control, and in the behaviour of feedback systems. Stability in linear systems. Analysis and synthesis of linear systems using root-locus and frequency response techniques. Criteria for satisfactory control. Use of computer techniques in control system analysis and synthesis.

Unit 3 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.

3.043 Chemical Engineering IIIC

Unit 1 Safety and Failure Tolerance **S1 L1**

Safe practices. Safety equipment. Handling and storage of hazardous materials. Disaster propagation, implications for plant and storage layout. Failure modes, the 'bath-tub' curve. Reliability theory, replacement and standby equipment. Criteria for reliability. Fault tree analysis. Accident analysis. Case histories. Factory visit.

Unit 2 Economics II **S1 L2**

Prerequisite: 3.032 Unit 4.

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 3 Atmospheric Pollution Control **S1 L1**

Introduction, dispersion of pollutants, source and ambient measurement and monitoring, industrial pollution control.

Unit 4 Water Pollution Control **S1 L1**

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.

3.044 Chemical Engineering Laboratory II S1 T3

Prerequisite: 3.036.

An integrated chemical engineering laboratory at a more advanced level than the 3.036 laboratory and with an emphasis on open-ended experiments.

3.090 Industrial Experience

Students are expected to accumulate, by the end of their full-time course, 12 weeks of industrial experience during recesses.

Advanced Chemical Engineering Electives

3.0451 Plant Layout II — S1 or S2 L1T1

Prerequisite: 3.032 Unit 2.

Piping: Underground, trenched and above-ground piping. Piping decks. Arrangements of process plant, process and service piping in process area. Pressure, weight and expansion stresses. Simple flexural analysis to estimate terminal reactions and stresses in pipes, valves and equipment. Providing for expansion, supporting and anchoring. Expansion take-up devices and their integrity. Economic determinants. Flexural design using computer software. Grouping of components. Pressure and flow distribution in piping-pump-equipment networks. Practical guidelines to good layout. Preparation of specifications and drawings. Codes, mandates and rules of regulatory bodies. Design of vent and drainage systems; example of poor design.

Plant layout: Site and battery plant layout to suit process, piping and operational requirements. Making the best use of topography. Preparation of plot and site plans and specifications. Logic operations and critical path planning. Project engineering.

Storage: Tank farm arrangement, layout and associated pumps and piping.

Miscellaneous: Pneumatic and slurry transfer systems. Steam reticulation, trapping and condensate handling. Detailed consideration of layout and piping around particular equipment items, and preparation of associated drawings.

3.0452 Advanced Chemical and Phase Equilibria — S1 or S2 L1T2

Prerequisites: 3.031 Unit 3.

Sources of thermodynamic data. Methods of estimating and presenting thermodynamic data. Advanced chemical and phase equilibria of application in chemical and process engineering.

3.0453 Control II — S2 L1T1

Prerequisite: 3.042 Unit 2.

Material covered in Control 1 is applied during tutorials to selected case studies, and is illustrated by laboratory work, and by analogue and digital computation. Lecture material complements the laboratory work, and introduces selected topics such as multi-look system control, system identification and estimation and sequencing control.

3.0454 Reactor Engineering — S1 or S2 L1T1

Differential balances with reaction, non-ideal homogenous reactors, reaction in mixing streams, rate equations for heterogenous reactions, non-catalytic fluid-solid, and fluid-fluid reactors, solid catalysed fluid reactors, examples of complex reactors.

3.0455 Fluid Particle Systems II — S2 L2

Prerequisite: 3.033 Unit 1 and 4.

Lectures and demonstrations dealing with fluidized and spouted bed techniques.

The history and application of fluidization. Fluidization characteristics of different materials. Regimes of fluidization particulate, aggregative, slugging to fast fluidization. Minimum fluidization and minimum bubbling velocity. Bubble phenomena: fluid mechanical description of bubbles, bubble growth and coalescence. The distributor region and gas jets. Solids movement, mixing and segregation. Entrainment of solids. Heat and mass transfer aspects. Modelling the fluidized bed as a reactor. Design and scale up considerations.

Spouted beds: criteria for spouting, minimum spouting velocity, maximum pressure drop. Gas and solids motion in the spouted bed. Design aspects and applications.

3.0456 Process Engineering II — S1 or S2 L1T1

Prerequisites: 3.031, 3.032, 3.033, 3.034, 3.035, 3.043.

Process Design: Use of Computer Aided Design flowsheeting for the screening of alternatives in process design. Discussion of matrix methods for representing process topology and for use in calculation of processes with recycle.

Process synthesis with particular reference to separation process sequences and heat exchanger networks.

Fault Detection and Correction: Detection, location and identification 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.

Equipment: Detailed chemical engineering design of selected equipment items.

3.0457 Oil and Gas Processing — S1 or S2 L2

Prerequisites: 3.311, 3.0313, 3.032.

Sources of data on hydrocarbon properties. Process design applied to gas and oil treatment plants, pipelines and storage. The petroleum refinery.

Applications of chemical engineering principles to refinery processes. Products blending. Refinery economics. Optimization of refinery operations. Design and operation of refinery equipment.

3.0461 Introductory Reservoir Engineering — S1 L2

Prerequisites: 3.311, 3.0313, 3.0331.

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.

3.0462 Advanced Reservoir Engineering S2 L2

Prerequisite: 3.046.

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.

Servicing Subjects

3.023 Chemical Engineering Science I

3.024 Chemical Engineering Principles I

3.037 Chemical Engineering Science II

3.038 Chemical Engineering Principles II

3.101 Computation and Modelling in Applied Chemistry

Department of Biological Process Engineering

3.211 Biological Process Engineering F L2T4

Prerequisite: 44.111.

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 optimisation 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.

3.240 Biological Process Engineering Project S1 T1 S2 T11

Project in Biological Process Engineering for students in Chemical Engineering.

Department of Fuel Technology

3.301 Fuel Engineering (for Mining Engineers) F L2T1

An elective introductory subject in fuels and energy for Mining Engineering students based on the subject 3.311 Fuel Engineering I, supplemented by appropriate laboratory experiments (consisting of 28 lectures and 14 hours of laboratory classes per session, taught over two sessions).

3.302 Fuels and Energy S2 4hpw

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. A variety of alternative energy sources and review of the national and global energy situation.

3.311 Fuel Engineering I

Unit 1 Fuels and Energy. Sources and Properties S1 or S2 L1

Fossil Fuels: coal, oil, gas; origin, 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 inflammability, 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.

3.321 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 compositions. 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.

3.331 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 from 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**

3.340 Fuel Engineering Project S1 T1 S2 T11

Projects selected involving the design of fuel plant or experimental aspects of fuel science and/or fuel processing and utilization.

No books are recommended. Students are supplied with reading lists appropriate to individual requirements.

Graduate Study

Department of Chemical Engineering

3.162G Urban Planning

Priorities in urban planning: topography, community services, industry; selective zoning and decentralization; relationships to regional planning. Cost of pollution and control measures; legal aspects; planned development; architectural aspects; density distribution. Case histories.

3.163G Industrial Water and Wastewater Engineering

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.

3.164G Medical Aspects

Aspects of medicine bearing upon physiological consequences of pollutants. Synergism and antagonisms; photosynthesis and phyto-toxicity, metabolic mechanisms; morbidity and mortality surveys; exposure indices. Particular pollutants: aldehydes, nitro-olefins, carbon monoxide, sulhur dioxide, oxides of nitrogen, hydrocarbons, ozone and oxidants, particulates, carcinogens.

3.166G 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.

3.170G Process Principles

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

3.171G 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.

3.172G Corrosion Laboratory

Laboratory assignments to illustrate and measure the mechanism of corrosion. Electroplating/anodising experiments.

3.173G 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.

3.174G 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.

3.175G 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.

3.176G 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.

3.177G Testing Laboratory

Candidates undertake a project involving the design/evaluation of corrosion testing equipment/techniques. A comprehenive report is submitted.

3.181G 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. *Nonlinear Systems:* Selected non-linear systems, eg, chemical reactors, flow systems, radiant heat transfer. Numerical solutions. Phase plane analysis. Limit cycles.

3.182G 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.

3.183G Equilibrium Concepts in Water Systems

The application and limitations of chemical thermodynamics in water systems. Particular attention is given to aqueous inorganic process systems including water treatment and minerals processing and with consideration of the effects and control of pollution.

Thermodynamic diagrams such as lnE/pH, potential/pH, temperature/pH and concentration/pH are developed as an aid to assessing system energetics.

Sources and estimation of thermodynamic data. Kinetics and mechanism in relation to aqueous system energetics. Analysis of kinetic data.

3.184G 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; programmaing 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.

3.185G 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.

3.186G 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.

3.187G Design of Process Envelopes

Not offered in 1980.

Theoretical treatments concerning stress analyses with time and temperature as variables, stresses at discontinuities and transitions in vessel geometry. Theories and modes of material behaviour, gas solubility effect, design of insulation, reinforcement, etc. Analyses of stresses and reactions in piping subject to large temperature changes. Code requirements. Practical aspects will include a treatment of high pressure components, eg, valves, fittings, pumps, safety devices. Economic aspects.

3.189G Graduate Colloquia

Colloquia on research developments in Chemical Engineering. Students are required to participate actively in the colloquia and give as least one dissertation based on their own investigations.

3.190G Specialist Lectures

3.191G Advanced Thermodynamics

Equilibrium: liquid-liquid, liquid-solid and liquid-vapour phase equilibria for 1. high pressure; 2. multicomponent systems. Chemical reaction equilibrium for complex systems.

Molecular theory and statistical thermodynamics: partition functions, monatomic and diatomic gases; Chapman-Enskog theory, evaluation of 1. thermodynamic potentials; 2. virial coefficients.

Compressible flow: flow of compressible fluids in ducts including 1. supersonic flow; 2. shock waves; 3. stagnation properties.

3.192G 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.

3.401G Chemical Engineering in Medicine

Application of chemical engineering principles to medicine. Introductory general physiology with particular emphasis on the kidneys, lungs and liver. Design and operation of hemodialyzers, membrane oxgyenators and hemoperfusion devices. Considerations of critera for optimal short- and long-term replacement to natural organs. Modelling of patient-artificial organ interactions. Associated laboratory work where appropriate.

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.

3.281G Design of Microbial Reactors

Unit 1 Rate Processes

This unit is a bridging course 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 3.045 Unit 6 Reactor Engineering.

Covers 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 prerequisite or co-requisite would be 44.111. 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.

Covers growth of an undifferentiated organism as a physico-chemical process leading to quantification of the growth processes. Overall structure of metabolic processes. Material, energy and redox balances under anaerobic and aerobic conditions. Specific metabolic rates and their quantification.

Unit 3 Design of Microbial Reactors

This unit would normally follow rate processes or fundamentals of microbial stoichiometry and is divided into two strands.

Reactor Design Fundamentals: Ideal and non-ideal reactors, residence time distribution and non-ideal reactor models. The significance of mixing and diffusion in microbial reactors for freely suspended microorganisms. The concept of a microfluid and a macrofluid and its application to the description of two-phase reacting systems — gas-liquid, oil-aqueous and solid-fluid systems will be examined with examples relevant to the biological process industries.

Microbial Reactor Calculations: The collection, quantification and interpretation of rate data, and the design of reactors for freely suspended microorganisms; batch, semi-batch and continuous reactors; gas exchange balances. Rate processes in microbial flocs and microbial films. Design for microbial floc and film reactors.

3.282G Microbial Kinetics and Energetics

Unit 1 Microbial Kinetics

Prerequisite or co-requisite; 3.281G 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: 3.281G 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.

3.283G Bioprocess Unit Operations and Equipment Design

Prerequisite or co-requisite: 3.284G 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.

3.284G Heat, Mass and Momentum Transport

A bridging course designed to provide an introductory understanding of the mechanisms of transport processes. This unit 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.

3.285G Bioprocess Laboratory

Practical experience in the industrial processing of biological and microbial systems. The essential nature of this work is 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.

3.380G Fuel Seminar

1 (SU) to be given in Session 2, compulsory in MAppSc (Fuel Engineering) degree course. Content bias to choice of G subjects.

3.381G Atmospheric Pollution and Control

Unit 1 (4 SU) Causes, properties, dispersion, monitoring control and legislation.
Unit 2 (4 SU) Advanced atmospheric pollution (extension for EPC, IPC courses only, Unit 1 is a prerequisite).

3.382G 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

3.383G 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

3.384G 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

3.385G 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

3.386G Unit Operations in Waste Management

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.

3.387G Fuel Technology Practice

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

3.900G Project

3.901G Minor Project

School of 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 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 L3T0

A condensed treatment of physical and mechanical metallurgy.

4.141 Experimental Techniques in Physical Metallurgy — L0T2

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

4.302 Chemical and Extraction Metallurgy I — 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 — L3T2

Prerequisites: 4.302, 4.602 and 4.402 or 4.412.

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 L1T0 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 — 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 changes; penalties and bonuses; by-products.

4.402 Physical Metallurgy I — S1 L3T3 S2 L2T4

Co-requisites: 2.002A, 4.502. Excluded: 1.932, 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 — L4T5

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. 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-requisite: 2.002A. Excluded: 1.932, 4.402.

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

4.414 Physical Metallurgy IIIA — S1 L3T1½

Prerequisite: 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. 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 IIIB **S1 L0T3 S2 L3T1½**

Prerequisite: 4.403.

Selection of advanced topics in physical metallurgy including radiation damage, martensitic transformations, neutron diffraction, internal 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 in metals.

4.502 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.

4.503 Mechanical Metallurgy **S2 L1T2**

Prerequisite: 4.502.

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, 4.503.

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**

Prerequisites: 4.433, 4.503.

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 L4T2 S2 L3T6**

Prerequisite: 4.623.

Process dynamics and automatic control. Dynamics of simple linear systems; representation and analysis of metallurgical processes by linear models; effect of various control elements; analysis by empirical models; design of control systems for metallurgical processes. Optimization: as for 3.042 Chemical Engineering IIIB, Unit 3. Atmospheric Pollution Control: As for 3.043 Chemical Engineering IIIC, Unit 3. Water Pollution Control: As for 3.043 Chemical Engineering IIIC, Unit 4.

Industrial Practice: Case studies, design studies and assignments related to industrial practice and integrated process schemes for metal extraction, refining, fabrication, treatment and finishing.

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 3.032 Chemical Engineering IIB Unit 4.

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 experimental 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 applications, 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 — L2T1

Prerequisites: 10.031 or 10.211A.

1. 10.351 Statistics SM (see Engineering Handbook)
2. Numerical Methods. Roots of equations. Finite differences, numerical differentiation and integration. Solution of ordinary differential equations; series and finite difference methods. Solution of partial differential equations; finite difference and iterative methods. Systems of linear equations; least squares analysis. Computing: Basic and Assembler languages. Application of the above methods and digital computers to the solution of metallurgical problems.

4.911 Materials Science — 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 — L2T1

The structure and properties of crystalline substances. Crystal structures, crystal planes and directions. Examination of crystals by X-ray, electron and neutron diffraction techniques. 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.

4.921 Materials Science — L1T0

The atomic structure of metals. The crystalline nature of metals and its significance. The solidification of metals. Plastic deformation of crystalline materials and its effect on properties. Phase equilibria in metallic alloys. The heat treatment of some ferrous and non-ferrous alloys. Corrosion. The electron theory of metals. Conductors, semiconductors and insulators. Magnetic materials — structure and properties.

4.931 Metallurgy — L1½T½

The atomic structure of metals. The grain structure of metals; origin; effects of manufacturing processes. Structure of alloys — theory. Structure, properties and heat treatment of commercially important alloys. The selection and properties of structural steels. Corrosion.

4.941 Metallurgy for Engineers — 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 — 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.

4.961 Materials and Corrosion — S1 L2

A short subject covering the theory of corrosion and materials of construction.

4.972 Materials for Mining Engineers — L1T½

Solidification of metals, structure and defects in castings and welds. Hard-facing techniques, powder metallurgical processes. Phase equilibrium in alloys and application to engineering materials. Non-equilibrium; heat treatment and modification of structure and properties. Elastic and plastic deformation. Mechanical processing. Fracture. Corrosion and corrosion protection in mining environments. Specification and selection of engineering materials.

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 S2 L1½T1½

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.

School of Mechanical and Industrial Engineering

Undergraduate Study

5.010 Engineering A SS L4T2

Prerequisite:

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

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: For subject descriptions see under 4.001.

5.020 Engineering B SS L4T2

Prerequisite: 5.010.

(For students in Applied Geology and Mining Engineering)

Engineering Dynamics: Kinetics of the plane motion of a particle; equations of motion, dynamic equilibrium, work and energy. Kinetics of systems of particles; impulse and momentum. Rotation of rigid bodies about a fixed axis. Belt, rope and chain drives, gear trains.

and

Mechanics of Solids I: 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 SS L/T6

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 either

Introduction to Chemical Engineering (Compulsory for Chemical Engineering students): Application of material and simple energy balances in chemical process operations. Primary reference to the oil, heavy chemical and related process industries with additional examples of the application of chemical engineering technology to identifying and solving problems in areas such as environmental pollution, food technology and medicine. See subject 3.001.

or

Introduction to Metallurgical Engineering: For subject description see under 4.002.

or

Introduction to Mining Engineering (Compulsory for Mining Engineering students): 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.

or

Introduction to Ceramic Engineering (Compulsory for Ceramic Engineering students): The nature of ceramics. Classification of materials. The materials science approach. History of ceramics. The ceramic engineer and society. The origin, classification, physical properties and use 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.

or

Introduction to Chemical Technology (Compulsory for Industrial Chemistry students): Introduction to computation in chemical technology; process flow diagrams, information flow diagrams, flow charts in computer programming, development of algorithms. Principle of operation of processors. Batch and real-time processing. Concepts of steady-state and unsteady-state simulation. Programming in Fortran IV and Real-Time Basic and of programmable calculators. Concepts of on-line data acquisition and reduction. Data processing of laboratory and plant data.

5.111 Mechanical Engineering Design I

Prerequisite: 5.010. Co- or prerequisites: 5.330, 5.611, 5.411 or 8.112, 8.259.

Introductory lectures illustrating the interdependence of design and technology. Mechanical technology. Interpretation of engineering drawing practice. Philosophy and technique of design. Simple creative design assignments. Basic engineering elements.

5.330 Engineering Dynamics F L/T2

Prerequisites: 1.001 or 1.011 or 1.951, 5.010 and 10.001 or 10.011.

Kinematics and kinetics of particles and rigid bodies in planar motion: absolute motion and motion relative to translating and rotating frames of reference; constraint and degrees of freedom; dynamic equilibrium, differential equations of motion; work and energy, variational principles; impulse and momentum, impact.

5.331 Dynamics of Machines I F L1½T½

Prerequisites: 5.330, 10.022.

Dynamics of Planar Mechanisms: Analytical and graphical methods for the analysis of velocities, accelerations and forces in planar mechanisms. Kinematics of gear tooth profiles. Static and dynamic rotor balancing.

Mechanical Vibrations: Simple harmonic motion. One degree of freedom systems, free and forced vibrations, transmissibility and motion isolation. Whirling of shafts.

5.411 Mechanics of Solids II F L1T1

Prerequisites: 5.010, 5.020.

Statics of frames and machines. Two dimensional stress components. Bending and shear stresses. Stresses due to combined loads. Three dimensional stress components. Stress-strain relations. Theories of static failure. Instability of elastic columns.

5.611 Fluid Mechanics/Thermodynamics I F L2T2

Prerequisites: 1.001 or 1.011 or 1.951, 5.010, 6.020, 10.001. Co- or prerequisites: 5.330, 10.022.

Dimensional systems, units, dimensional analysis, properties of substances. Statics of Fluids. One dimensional flow. Mass, energy and momentum equations. Laminar and turbulent motion. Flow in pipes. Elementary boundary layer theory. Drag. Fluid measurements. Angular momentum equation. Turbo-machines. Concepts and conservation principles of thermodynamics. First and second laws of thermodynamics. Properties of ideal gases, liquids and vapours. Non-flow and flow processes. Ideal cycles. Factors limiting performance of real cycles.

5.6111 Fluid Mechanics F L1T1

Prerequisites: 1.001 or 1.011 or 1.951, 5.010, 5.020, 10.001. Co- or prerequisites: 5.330 or 5.311, 10.022.

Dimensional systems, units, dimensional analysis, properties of substances. Statics of fluids. One-dimensional flow. Mass, energy and momentum equations. Laminar and turbulent motion. Flow in pipes. Elementary boundary layer theory. Drag. Fluid measurements. Angular momentum equation. Turbo-machines.

School of Electrical Engineering

Undergraduate Study

6.832 Industrial Electrical Machinery S2 L1T2

Prerequisite: 1.001 or equivalent.

An applications-oriented introduction to the usage of electrical machinery in industry. Provides a basis of circuit-theory then considers the characteristics and selection of electrical machinery, their interface with the prime power supply, protection and electrical safety. Included is a project illustrating the application of electrical engineering to other disciplines.

6.851 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.

6.852 Electrical Machinery and Supply **S2 L1T2**

Prerequisite: 6.851.

A user-oriented introduction to the usage of electrical power in industry, covering the characteristics and selection of electrical machinery, their interface with the prime power supply protection, electrical safety and compliance with Australian standards. Included is an applications-oriented interdisciplinary project.

School of Mining Engineering

Undergraduate Study

7.013 Principles of Mining and 7.013R **S1 L1T1 F L1**

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 and 7.023R **S1 L1T1 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

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.

7.111 Introduction to Mining Engineering **S2 L2**

Forms part of 5.030 Engineering C.

Mineral deposits: metallic, non-metallic and fuels. Elements of prospecting and exploration. Basic mining techniques. Mining phases: development, exploitation, beneficiation and withdrawal. Mining and the environment. Mining services. Relevance of basic science and engineering subjects to mine design and operation.

7.112 Mineral Resources and 7.112R **S1 L1**

Historical and economic introduction, definitions. Geological time scale. Renewable and non renewable resources. Types of mineral resources, their abundance, distribution and availability. The consumption and use of metals, precious stones, industrial minerals and rocks, fossil and nuclear fuels. Ownership and leasing of mineral rights. Exercises in mine planning.

7.113 Mining Methods **F L2**

Prerequisite: 7.122.

Types of occurence; 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 and 7.114R **F L2T1 F L2T2**

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.

7.122 and
7.122R Mine Development **S2 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.

7.123 and
7.123R Geomechanics **F L1T2**

Prerequisites for 7.123: 8.172, 8.250, 10.341, 10.002.

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 Mechanisation **F L2T1**

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.

7.125R Introduction to Geotechnical Engineering **S1 L1T1**

Review of stress and strain analysis. Failure criteria. Classification systems for rocks and rock masses. Engineering properties of rocks and soils.

7.133 and
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.

7.134 Metalliferous Mining Systems **F L2T1**

Prerequisite: 7.113.

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.

7.143 and
7.143R Mine Environment and Safety Engineering **F L1T1½**

Prerequisites for 7.143: 5.611, 7.122.

Natural and artificial 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 L2T1**

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 and 7.153R **S2 L1T½**
S1 L1T½

Prerequisites for 7.153: 6.851, 5.611.

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-inflammatory oils. Components and circuits. Pumps, motors, valves. Speed and torque control.

7.154 Petroleum Engineering **F L2T1**

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**
and 7.163R **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.

7.164 Tunnel Engineering **F L2T1**

Scope for tunnels. Site investigation. Primary excavation in soft and hard ground. Drilling and blasting. Tunnelling shields, full face boring, partial face machines. Hybrid systems. 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 and all rail tunnels.

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.

7.193R 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**
and 7.213R **F L1**

Prerequisites for 7.213: 10.341 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**
and 7.214R **F L3T3**

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**
and 7.224R **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

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: 25.101 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 and
7.314R Mineral Process Technology **F L2T1**

Prerequisite for 7.314: 7.313.

Broken Hill students take 7.313R.

Physics and chemistry of surfaces. Measurement of surface properties.

On-stream and laboratory analysis and measurements. Laboratory and pilot plant 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.

7.316R Mineral Processing II

Properties of minerals. Applied mineragraphy. Selection of beneficiation processes. Gravity and other physical separation processes. Surface chemistry and froth flotation. Chemical processing and extraction, bacterial leaching. Process engineering, flowsheet and plant design. Market preparation.

7.326R Mineral Industry Processes

Principles underlying extraction of some common metals, pyro-metalllurgy, hydrometallurgy, electro-metallurgy, chemical extraction, agglomeration, sintering, mineral processing as a bridge between mining and metallurgical industries.

7.411R Fluid Mechanics

Statics of fluids. One dimensional flow. Mass, energy and momentum equations. Laminar and turbulent motion. Flow in pipes. Elementary boundary layer theory. Drag. Fluid measurements. Angular momentum equation. Turbomachines.

7.414 Minerals Industry Project F L1

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 S1 S2 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.

Graduate Study

Generally the 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 feasbility 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.

7.442G Mineral Industry Analysis

Advanced work in the technical and economic analysis of mining or mineral operations. Cases are selected for examination and analysis, and a critical review must be written of the operations analysed.

School of Civil Engineering

Undergraduate Study

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 L1½T½

Prerequisite: 8.170.

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.

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

8.820G Structural Analysis and Finite Elements I (SAFE 1) — 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.

8.753G 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.

School of 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 school 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 S1 L2T4

Introduces the principles of Wool and Pastoral Sciences. Covers the sheep and cattle industries and wool and meat as end products of these industries; production and use of pasture, nutrition of grazing ruminants; reproduction in sheep and cattle; climate and animal production; and introduction concepts of animal health.

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. Cross-breeding, prime lamb production.

Sheep and cattle management; nutrition, reproduction, survival.

A field excursion of one week's duration is held in session 1.

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 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, nematodes. Legal and Public Health responsibilities; Acts of Parliament relating to animal health.

9.132 Animal Health 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 L1½T1½

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).

The course involves one week of instruction at Fowlers Gap Research Station.

9.301 Agricultural Economics and Management I S1 L2 S2 L2T2

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 introduciton 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 stimulation methods.

9.411 Agricultural Chemistry I — F L1T3

Prerequisite: 2.131.

An integrated program in various aspects of chemistry directed to the special interests of pastoral science. Experimental techniques, preparative and analytical, built around biological interest. Correlations of theoretical chemistry with biological processes.

Treatment of separation techniques, theory and design of chromatographic and distillation processes. Reaction principles, functional groups, analytical chemistry and roles in biological processes. Colorimetric and spectrophotometric control. Oxidation reactions and electron transfer. Separations and reactions of proteins, fats and carbohydrates, chemical and physical properties, cyanogenetic glycosides.

Isomerizations and transesterification. Colloids and gel structures. Introductory heterocyclic chemistry, poisonous plants and alkaloid detection. Trace metals and soil analysis.

9.412 Agricultural Chemistry II — F L2T4

Prerequisite: 9.411.

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. Photochemistry, energy transducers. Isotope techniques.

9.421 Animal Nutrition — S2 L3T1

Composition and classification of foodstuffs and pastures. Physiology of ruminant digestion. Digestion absorption and metabolism of carbohydrates, proteins, fats, minerals 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; organisational 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 — S2 L3T3

Prerequisite: 17.021.

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 **F L2T½**

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 of covariance. Non-linear regression.

9.901 Rural Extension **F L2T2**

Development of communication skills through experiential or active learning situations. 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.

9.504G 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.

School of Mathematics

Undergraduate Study

10.001 Mathematics I **F L4T2**

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics	*71-100*
or	
3 unit Mathematics	*21-100*
or	
4 unit Mathematics	*1-100*
or	
10.021B	

*Excluded**: 10.011, 10.021A, 10.021B, 10.021C.*

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

**If a unit in this list is counted the unit above may not be counted.

10.011 Higher Mathematics I — F L4T2

Prerequisites:

	HSC Exam Percentile Range Required
3 unit Mathematics	*71-100*
or	
4 unit Mathematics	*11-100*

*Excluded**: 10.001, 10.021A, 10.021B, 10.021C.*

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

10.021A General Mathematics IA* — S1 L4T2

Number systems (including absolute value, inequalities, surds, etc.); coordinate geometry; polynomials, quadratics; concepts of the function; trigonometric functions, logarithmic and indicial functions and their laws of operation; introduction to differentiation and integration with simple applications.

10.021B General Mathematics IB — S1 or S2 L4T2

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Mathematics	*51-100*
or	
3 unit Mathematics	*11-100*
or	
4 unit Mathematics	*1-100*
or	
10.021A	

*Excluded**: 10.001, 10.011.*

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, 10.021A.*

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 10.021C (Cr.).

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.

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. 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, orthogonalization, projections. Unitary and self-adjoint transformations. Quadratic and Hermitian forms.

10.1113 Pure Mathematics II — Multivariable Calculus — S1 or S2 L1½T1

Prerequisites: 10.001. 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. 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. Excluded: 10.111A, 10.1111.

Linear Algebra: vector spaces, commutative rings, polynomials, modules, linear transformations, eigenvectors, invariant subspaces,

*Entry to General Mathematics IA is allowed only with the permission of the Head of the School of Mathematics, and that permission will be given only to students who do not qualify to enter General Mathematics IB.

**If a unit in this list is counted the unit above may not be counted.

‡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.

†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.

canonical forms, linear functions, bilinear and multi-linear algebra. Group Theory: sub-groups, quotient groups, isomorphisms, Lagrange's theorem, Sylow's theorem.

10.1213 Higher Pure Mathematics II — Multivariable Calculus **S1 L2T½**

Prerequisite: 10.011. Excluded: 10.1113.

As for 10.113 but in greater depth.

10.1214 Higher Pure Mathematics II — Complex Analysis **S2 L2T½**

Prerequisite: 10.1213. Excluded: 10.114.

As for 10.114 but in greater depth.

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

Prerequisite: 10.001. 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**

Prerequisite: 10.001. Excluded: 10.2212, 4.813.

Series solution of 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 Dist. 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.

School of Psychology

Undergraduate Study

12.001 Psychology 1 **F L3T2**

An introduction to the content and methods of psychology as a behavioural science, with emphasis on the biological and social bases of behaviour, relationships to the environment, and individual differences. The course includes training in methods of psychological enquiry, and the use of elementary statistical procedures.

School of 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: Introduction, historical development. Principles and practices of manufacture of yarns on the cotton and worsted systems.

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: Principles and practice of yarn manufacture for wool on the woollen system and for other natural fibres such as silk, flax, jute, etc. Fancy yarns, paper yarns, twistless yarns. Manufacture of yarns from man-made fibres and blends with natural fibres.

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. Relationship 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

(a) General analysis of textile structures. Flexure and torsion of a twisted yarn. Flexure and shear properties of fabrics. Mechanisms of fabric deformation.

(b) Varieties of macromolecules. Interactions with macromolecular structures. The physical properties of polymeric solids (including biopolymers). Absorption and the role of water in polymers.

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.

School of Accountancy

Undergraduate Study

14.081 Introduction to Financial Analysis **S2 LT4**

Prerequisite: Nil.

Aims to provide students, other than those enrolled within the Faculty of Commerce, with an understanding of the basic concepts and principles necesasry to make effective financial management decisions.

The nature of financial management; the business environment; financial analysis, planning and control; capital investment decisions; organization of the financial structure; operating and working capital management; growth and development; and the causes and prevention of financial instability and failure.

Specific industry studies.

14.501 Accounting and Financial Management IA **S1 or S2 LT4½**

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 LT4½**

Prerequisite: 14.501.

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

14.602 Information Systems IIA **S1 or S2 L2T1**

Prerequisite: Nil.

Introduction of Information Systems in business and commerce; systems design concepts; the theory of modelling; feasibility studies; internal control and auditing. An introduction to programming.

School of Economics

Undergraduate Study

15.001 Microeconomics I **S1 or S2 L2T1½**

An introduction to micro-economic analysis and its application to contemporary policy issues. The 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 proprety rights.

15.002 Microeconomics II **S1 L2T2**

Prerequisites: 15.011 plus

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

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

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

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

Prerequisite: 15.011.

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 The Soviet Economy

Prerequisite: 15.002 or 15.072.

A study of how basic economic problems are solved in the contemporary Soviet economy within a socialist institutional framework. The emphasis is on analysis of the actual operation of the Soviet economy and on an assessment of the extent to which and the efficiency with which it meets its own posited goals. For comparative, illustrative and analytical purposes reference is also made to other East European socialist countries, including Yugoslavia.

15.053 Economic Development — S2 L2T1

Prerequisite: Any Year II Economics subject.

The gap between the welfare of the rich and the poor nations. Earlier theories of development as a basis for an appreciation of the various economic and non-economic theories of underdevelopment; such as social and technological dualism, balanced and unbalanced growth, structural change and development. The general principles and techniques of development planning and their application in particular countries.

15.073 Natural and Environmental Resources Economies — S2 L2T1

Prerequisite: 15.002 or 15.072 with the approval of the Head of the Department of Economics.

An introduction to the concepts and issues in the management and evaluation of natural and environmental resources.

15.082 Labour Economics — S1 L2T1

Prerequisite: Any Year II Economics subject.

The theory of the labour market 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 and job satisfaction; unemployment and underemployment; wage theory and practice, with reference to market forces, collective bargaining and government regulation; the Australian arbitration system and its inter-action with other wage determinants; wage differentials.

15.093 Public Sector Economics — S1 L2T1

Prerequisite: 15.002 or 15.072 with the approval of the Head of the Department of Economics.

Public goods and social issues, such as poverty, health, education, transport and conservation. Analysis of case studies employing cost-benefit analysis to evaluate public projects and examine economic, social and environmental impacts of investment projects. The pricing policies of public utilities.

15.103 International Economics — S2 L2T1

Prerequisite: 15.002 or 15.012.

The international economy, the 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 — S1 or S2 L2T2

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.

15.501 Introduction to Industrial Relations — S1 or S2 L2

Prerequisite: Nil.

For student enrolled in Faculties other than Commerce and Arts. It is designed to provide a practical introduction to important industrial relations concepts, issues and procedures. Topics covered include 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 the the Australian Conciliation and Arbitration Commission and the N.S.W. 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.

15.601 Economic History IA — The Making of Modern Economic Society S1 or S2 L2T1½

Prerequisite: Nil.

Analysis of the forces that have determined the pattern and course of economic and social development in the twentieth century. Modern problems placed within a historical perspective including the relationship betwen economic growth, the emergence of the corporate economy, and the changing quality of life. The development of interdependence in modern economies in terms of the growth of big business, multinational enterprise, and changes in the distribution of income since the nineteenth century. Use of historical material as the basis of understanding of the background to the contemporary economic world.

15.611 Economic History IB — Australian Economic Development in the Twentieth Century S1 or S2 L2T1½

Prerequisite: Nil.

The development of the Australian economy from the Long Boom and the deep depression at the end of the nineteenth century to the present day. Topics include: a general overview of Australian economic development and its main features; economic fluctuations and their consequences, especially the Great Depression of the 1930s; the rise of Australian economic institutions; changes in the philosophy of development and the role of the State; impact of war; migration and the development strategies of the States; the growth of manufacturing and the creation of an industrial base; problems of the rural sector; and changes in the Australian standard of living. Throughout the course particular attention is given to Australia's changing economic relations with other countries.

Biological Sciences

Undergraduate Study

Students must obtain a 'course guide' during Orientation Week from the Biology Information Centre, Laboratory A, Ground Floor, Biological Sciences Building.

17.031 Cell Biology S1

Prerequisite:

	HSC Exam Percentile Range Required
2 unit Science (any strand)	*31-100*
or	
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, gene interaction, sex determination, mutation, selection and evolution; information transfer and protein synthesis.

17.021 Biology of Higher Organisms S2

Prerequisite: 17.031.

The diversity of living things and the ways in which they have adapted to varying environments. Emphasis on flowering plants and vertebrate animals, and the complex organ systems they possess. The structure and function of these organs, as well as their coordination and control, examined in practical experiments to form the basis of lecture and tutorial programs.

Department of Industrial Engineering

Undergraduate Study

18.121 Production Management F L3TO

Prerequisites: 10.031, 10.331.

Engineering Economy: Economic objectives of the firm. Economic measures 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, simulation.

18.551 Operations Research F L2T1

Prerequisites: either 5.071 and 18.021 or 10.031, 10.331 and 18.121.

The formulating and optimization of mathematical models. The development of decision rules. Some techniques of operations research such as mathematical programming, queuing theory, inventory models, replacement and reliability models, and simulation will be introduced. These techniques will be applied to situations drawn from industrial fields, eg production planning and inventory control. Practical problems of data collection, problem formulation and analysis will be included.

School of Chemical Technology

Undergraduate Study

22.101 Introduction to Chemical Technology S2 L2

22.101 is an option in 5.030 Engineering C.

Philosophy and structure of courses in chemical technology. Materials of construction. Safety procedures. Environmental problems — air and water pollution, waste disposal, water recirculation. Preparation of flow sheets. Brief resume of some important industrial processes. The use of a computer as a tool. Writing of simple programs. Methods of supplying data. Use of programmable calculators. The Library: how it functions. The Library as a source of data. Machine based information retrieval.

22.112 Chemical Process Equipment S2 L2

Co- or prerequisite: 2.001, 2.121, 2.131.

Review of services in the chemical industry; the principles of operation, construction and fields of application of equipment used in carrying out various processes and operations in the chemical industry.

22.113 Industrial Chemistry Processes F L1½T2

Prerequisites: 2.002A, 22.112. Co- or prerequisites: 2.002B, 2.042C.

A study of 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.

22.114 Processes S2 L2

Prerequisite: 22.113.

Topics selected from the following are studied in depth: refractories, high-temperature processes, high pressure processes (especially ammonia synthesis — thermodynamics and equipment), nuclear metals, industrial polymers, fermentation industries (for details see 42.114 Fermentation Processes), applied electrochemistry, applications of thermodynamics to gas/solid and aqueous systems concerned with the processing of inorganic materials.

22.122 Instrumental Analysis F L1T3

Prerequisites: 1.001, 2.121, 2.131. Co- or prerequisites: 22.132.

Basic principles of volumetric and gravimetric analysis and the application of spectrometric and selected techniques to the analysis of process streams and quality control.

22.123 Chemical Thermodynamics and Kinetics S1 L2T2 S2 L1½T1½

Prerequisites: 2.002A, 22.132. Co- or prerequisite: 22.133, 22.153.

Thermodynamics: the laws of thermodynamics, power cycles, thermodynamics of fluids, heterogeneous equilibrium, chemical reaction equilibrium, irreversible thermodynamics.

Kinetics: kinetics of homogeneous reactions, analysis of rate equations of reversible and irreversible reactions. Design fundamentals of industrial reactors during operation under isothermal, adiabatic and non-isothermal conditions. Kinetics of polymerization processes, control of polymer properties by kinetic considerations.

22.124 Applied Kinetics S1 L2T1

Prerequisite: 22.123.

The defect solid state; solid-state diffusion; heterogeneous catalysis and heterogeneous kinetics; continuous stirred tank reactors; semibatch reactors; tubular reactors; fixed bed catalytic reactors; optimization, scale-up of reactors; residence time distributions.

22.132 Industrial Chemistry Calculations — S1 L2T1 S2 T1

Prerequisites: 2.121, 2.131, 10.001.

Conversion of units; the role of stoichiometry in industrial chemistry; the influence of the dynamic situation; transposition of chemical and physical data; evaluation of the accuracy of data from experimental analytical measurements. Development of algorithms for the solution of selected examples relevant to the process chemical industry.

22.133 Data Processing — S1 L2T2 S2 L2T1

Prerequisites: 10.331, 22.132.

Computer programming and numerical methods: Fortran IV and Basic II programming, solution of equations (Newton-Raphson), simultaneous linear algebraic equations, numerical differentiation and integration, interpolation, ordinary differential equations, partial differential equations, least squares approximations, matrix operations, numerical optimization (Simplex method), linear programming, linear models with one and more than one independent variable, non-linear models. Application of the principles of statistics to chemical problems (z test, t test, F test and X^2 test), analysis of variance, design of experiments, correlation and regression, quality control. Use of graphical methods; fitting empirical equations to experimental data. Preparation of nomograms using constructional determinants.

22.134 Applied Thermodynamics — S1 L1T1

Prerequisites: 22.123, 22.153.

Calculation of thermodynamic properties, statistical methods for calculation of thermodynamic properties of gases from spectroscopic data, thermodynamics of non-ideal solutions, polymers and the glassy state, changing standard states. A study of heterogeneous equilibria in multi-component systems with particular emphasis on systems of practical importance.

22.143 Introduction to Analog Computation

A course of 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.

22.153 Material and Energy Balances — S1 L1T2

Prerequisites: 2.002A, 10.031, 22.132.

Units, material balances, gases, vapours and liquids, energy balances, combined energy and material balances, unsteady-state material and energy balances.

22.154 Process Simulation — S1 L2T1 S2T1

Prerequisites: 3.111, 22.113, 22.123, 22.133, 22.153, 22.163.

The application of the hybrid computer to the study of the dynamics of processes encountered in the chemical industry.

22.163 Instrumentation and Process Control I — S2 L1½T1½

Prerequisites: 1.922, 10.031, 22.122 or 2.002D. Co- or prerequisite: 22.113 or 22.233.

Analog computation: theory and application of basic analog computing elements, magnitude scaling and time transformation, application to solution of linear differential equations with constant coefficients. Transducers. Measuring instruments, indicators and recorders: analog type instruments, digital measuring instruments, data-logging systems. Introduction to process control: block diagrams, feed-back, transfer functions, final control elements and characteristics, introduction to controllers, empirical timing of controllers.

22.164 Instrumentation and Process Control II — S1 L2T3

Prerequisite: 22.163.

Analog computation: programming techniques, representation of non-linear phenomena, application to non-linear differential equations. Process dynamics: first order processes, response of single and multiple first-order systems to a variety of forcing functions, second and higher order processes, state variable presentation of processes, the complex plane, frequency response of linear systems, identification of ill-defined processes from analysis of indicial response data. Dynamics of closed-loop systems: closed loop transfer functions, derivation of characteristic equation, performance criteria, non-linear and linear controllers, transient response of linear control systems.

Analysis and design of simple control systems: root locus method. Naslin's Method.

22.174 Seminars — F T3

Co- or prerequisite: 22.184.

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.

22.184 Process Analysis — F T2

Prerequisites: 22.113, 22.133, 22.163. Co- or prerequisites: 22.124, 22.134.

An assignment on the integrated design of process flow diagrams involving specification of basic chemical reactions and physico-chemical parameters, selection of types of equipment required, statement of variables to be measured for the control of raw materials, process conditions and final product, and the preparation of a process model suitable for automatic control.

22.194 Project (Industrial Chemistry) — S1 T6 S2 T8

An experimental or technical investigation related to some aspect of industrial chemistry. Prerequisites and/or co-requisites will be determined depending on the nature of the project.

22.213 Chemical Ceramics — S1 L3T3 S1 L2T3

Prerequisites: 2.002A, 2.002C, 2.002D. Co- or prerequisites: 22.123A, 22.233, 25.201.

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.

22.224 Physical Ceramics — F L2T4

Prerequisites: 22.213, 22.233.

Physical Ceramics: Application of the principles of physical chemistry and solid-state physics to a study of the preparation and properties of ceramic materials. *Clay Mineralogy*: Structures and properties of the various clay minerals; techniques employed in the identification of clay minerals; composition and properties of the ceramic clays of New South Wales.

22.231 Introductory Ceramic Engineering — S2 L2

22.231 is an option in 5.030 Engineering C.

The nature of ceramics. Classification of materials. The materials science approach. History of Ceramics. The ceramic engineer and society. 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.

22.232 Ceramic Engineering I — S2 L3

Co- or prerequisites: 3.311, 7.023, 22.232.

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.

22.233 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.

22.234 Ceramic Engineering II — F L2T2

Prerequisites: 3.111, 8.112, 22.233, 22.232.

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.

22.294 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.

22.303 Polymer Science — S1 L2 S2 L2T2

Prerequisites: 2.002A, 2.002B, 10.031, 10.331. Co- or prerequisites: 3.111, 22.113.

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.

22.314 Polymer Chemistry — S2 L1

Prerequisite: 22.303.

Inorganic polymers, polymers for high temperature service, the use of modern instrumental methods for establishing composition and structure of high polymers.

22.324 Physical Chemistry of Polymers II — S2 L1

Prerequisite: 22.303.

Selected topics from basic texts and the original literature, covering anionic polymerization, polymer degradation, polymer rheology, polymer, visco-elasticity, fracture and environmental stress cracking, polyelectrolytes.

22.334 Polymer Physics II — S2 L2

Prerequisite: 22.303.

Rubber elasticity, extrusion plastometry, rheological aspects of polymer processing operations.

22.341 Statistical Techniques S1 L1T1

Prerequisite: 10.331.

The application in the Polymer industry of the z test, t text, X squared test and F test, correlation of one and two variables, single factor and two factor analysis of variance.

22.412 Ceramic and Polymer Materials F L2

Ceramic Materials: History of ceramics, introduction to ceramic raw materials, processing of ceramics including forming, drying, firing, introduction to crystal chemistry and phase changes in ceramics, the nature and properties of crystalline ceramic glasses, ceramic fibres and composites.

Polymer Materials: Introduction to the chemistry, industrial processing, physical and chemical properties and uses of the principal types of polymers of commercial importance. Includes thermoplastic and thermosetting materials for use as plastics, rubbers, sealants, adhesives, coatings and fibres with emphasis on materials produced, manufactured or processed in Australia.

Graduate Study

22.110G Process Evaluation F L1T2

Critical scientific and economic evaluation of industrial chemistry processes and research and development procedures. Process methodology, physico-chemical data and their implications, equipment and control parameters. Novel and controversial chemical processes relevant to the Australian chemical industry.

22.120G Machine Computation in Chemical Technology S1 or S2 L2T4

Applied numerical methods for solution of industrial chemistry problems; statistical methods including non-linear and multiple regression; model discrimination and experimental design methods; plant tests and product quality control experiments; numerical optimization techniques.

22.130G Chemical Reactor Analysis and Control S1 or S2 L2T4

Concepts of heat and mass transfer; analysis of fixed-bed catalytic reactors; fluidized beds and catalytic risers; residence time distributions; maximum mixedness and segregated flow; multiple steady states; control of tubular and stirred tank reactors.

22.131G 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.

22.140G Chemical Process Simulation S1 or S2 L2T4

The simulation of chemical process models using analog and digital computers. Analog and digital computer simulation techniques. The role and application of hybrid computers to the chemical industry, including simulation techniques.

Optimization of chemical reactions by simulation. The economics of simulation. Practical simulation studies of selected industrial chemical processes.

22.141G Modelling in Chemical Technology S1 or S2 L2T4

Basics of modelling methods and their relationship to chemical industry.

The modelling of dynamics physico-chemical processes common to the chemical industry including the systems and subsystems approach; continuous- and discrete-time physical process models; lumped- and distributed-parameter models; evolution of models from fundamental physico-chemical principles. Approximation methods for complex and ill-defined chemical processes. Integrated chemical process models.

22.142G Chemical Process Control S1 or S2 L2T4

Data acquisition from chemical instrumentation and its application to the control of chemical processes. Modern control techniques in the chemical industry including non-linear control, linear digital control, multivariable process control systems, and optimal control.

22.150G 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.

22.160G Industrial Electrochemistry S1 or S2 L2T4

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. Automation and control for optimum conditions.

22.161G 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.

22.210G Solid State and Mineral Chemistry F L2

Principles of crystal chemistry; structures of selected crystal types and glasses. Thermodynamics of solid systems; phase relations. Defects in crystals; non-stoichiometry. Solid state diffusion. Thermodynamics and kinetics of solid state reactions. 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 fields; solid state electrolytes; biodegradation of rocks and minerals. Chemical strengthening of ceramics.

22.220G Refractory Technology I S1 or S2 L4T2

Chemical Property and Service Behaviour: This subject 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 reactions occurring between refractories and solid, liquid and vapour phases will be made. 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 22.213 Chemical Ceramics (Session 1).

22.221G Refractory Technology II S1 or S2 L4T2

Engineering Properties and Applications: This subject deals with the philosophy and methods of development of refractories, the thermodynamic stability 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 zirconia 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 22.233 Ceramic Engineering I.

22.230G 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.

22.300G Polymer Science S1 or S2 L6T4

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.

22.310G Analytical Characterization of Polymers S1 or S2 L4T4

Composition of formulated polymeric material. Group reactions, specific and colour reactions. Instrumental characterization of polymers, and co-polymers and associated additives eg plasticizers, anti-oxidants, etc. by UV and IR spectrophotometry and pyrolysis gas chromatography. Analysis of films by transmission and reflectance spectrophotometric methods. Thermal analysis.

22.330G 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.

22.340G 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.

22.900G Major Project

A substantial experimental project on some aspect of industrial chemistry, ceramic engineering or polymer science involving at least 6 hours study per week for one year or its part-time equivalent.

22.901G Minor Project

A minor experimental or technical investigation on some aspects of industrial chemistry, ceramic engineering or polymer science involving attendance for not less than 3 hours per week for one year or its part-time equivalent.

School of 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.

School of Applied Geology

Undergraduate Study

New course 3000 subjects.

25.110 Earth Materials and Processes S1 L2T4

Prerequisites:

	HSC Exam Percentile Range Required
2 unit Science (any strand)	*31-100*
4 unit Science (multistrand)	*31-100*

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 one and a half days is a compulsory part of this subject.

25.120 Earth Environments and Dynamics S2 L2T4

Prerequisite: 25.110.

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 three and a half days is a compulsory part of this subject.

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. Igenous 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.

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 siliceous deposits.

Metamorphic Petrology: Origin and classification of metamorphic rocks as an aid in understanding common mineral assemblages. Petrographic studies of common metamorphic rocks. Field studies.

Structural Geology: Origin, classification and description of 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 10 days, equivalent to 28 tutorial hours is an essential part of the subject.

25.212 Earth Environments I — S1 L3T3

Prerequisite: 25.120.

Sedimentology: Flow regimes and bedding forms, sedimentary structures. Flume experiments. Modern and ancient sedimentary environments of deposition: alluvial, deltaic, coastal, shelf and deep sea. The facies concept.

Stratigraphy: Stratigraphic classification including the Code of Stratigraphic Nomenclature. Time in stratigraphy. An introduction to radiogenic methods of age determination: ^{14}C, K/Ar, Rb/Sr and fission track methods. The evolution of continental margins and geosynclines. Geological evolution of the New England Orogen.

Palaeontology: Morphology and stratigraphic distribution of invertebrates, including Foraminifera, Brachiopods, Mollusca, Arthropoda, Protochordata and Echinodermata. Introductory palaeobotany. Palaeoecology. Biogeography. Trace fossils. Reef building organisms and the evolution of reefs.

Field Work of up to three days, equivalent to seven tutorial hours is an essential part of this subject.

25.223 Earth Physics — S2 L2T4

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.

Exploration Geophysics: Physical properties of rocks and soils. An introduction to electrical, electromagnetic, seismic, gravity, magnetic 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.

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 rocks, 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.

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.

Economic Mineralogy: Nature of reflected light. Orthoscopic and conoscopic rotation, dispersion phenomena. Microhardness and reflectivity, etch tests, XRD and microprobe techniques. 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.

Geochemistry: Some modern methods of rock and mineral analysis. Accuracy, precision and quality of geochemical data. The distribution of elements in terrestrial rocks. Norms.

25.321 Earth Materials IV — S2 L3T3

Prerequisite: 25.311. Co-requisite: 25.326.

Clay Mineralogy: The structure and properties of the clay mineral 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.

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 seven days is an essential part of the subject.

25.312 Earth Environments II — S1 L3T3

Prerequisite: 25.212.

Stratigraphy: Biological and physical methods of correlation. Definition of international stratigraphic boundaries, stratotypes and reference points. 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. Stratigraphic and structural evolution of aulacogenes.

Palaeontology: Theories of biological classification. The origin and early history of life. Processes and theories of evolution. Functional morphology. Practical applications of palaeontology.

Sedimentary Basin Analysis: Techniques of sedimentary basin analysis and data presentation: outcrop, borehole sections and logs, seismic sections. Structure, isopach and lithofacies maps. Seismic stratigraphy. Analysis of sedimentary facies and sequences in fluvial, deltaic, nearshore and deepwater environments. Interaction of sedimentation and structure in tensional, compressive and strike-slip tectonic regimes. Basin evolution.

25.313 Exploration and Data Processing — S1 L4T2

Prerequisite: 25.223.

Exploration Geophysics: The practice and theory of geophysics as a basic tool of geological exploration with applications in areas of energy, mineral and ground-water resources and engineering projects.

Mathematical Geology: An introduction to develop proficiency in the acquisition, display and analysis of geological data utilizing digital computer processing. Elementary descriptive and inferential statistics and sampling. Fortran programming language (including hands-on computing experience). Analytical methods of mathematical geology including time series analysis, Markov Chain analysis, map analysis and multivariate identification and classification techniques. A practical approach is adopted throughout whereby the student makes extensive use of a library of programs implemented on the University's CDC

multi-mainframe Cyber 72/171 installation for processing and interpretation of real data.

Field Work of up to five days is an essential part of the subject.

25.314 Mineral and Energy Resources I — S1 L3T3

Prerequisite: 25.221. Co-requisite: 25.311.

Metallic Resources: Classification and origin of ore deposits, geochemical processes, research methods. Orthomagmatic, hydrothermal, porphyry, volcanic-sedimentary, Mississippi Valley type, chromium, iron, manganese ores, residual and mechanical ores. Introduction to mineral exploration. Laboratory study of hand specimens, thin sections and polished sections of various ore types; study of selected mining areas representing various genetic types of ore.

Field Work of up to six days is an essential part of the subject.

25.324 Mineral and Energy Resources II — S2 L3T3

Prerequisite: 25.312.

Non-metallic Resources: 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.

Advanced Structural Geology: Analysis of structural elements at the microscopic, mesoscopic and macroscopic scales. Modern methods of petrofabric analysis. Detailed studies of the analysis of metamorphic terrains, eg Otago Schist, Cooma Complex.

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 nets. Case studies on the Great Artesian Basin and on 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: The shoreline processes. Littoral and longshore drifts and net sand movement. Coastal engineering works. The estuarine environment: sedimentation, chemical and biological processes. Investigation techniques.

25.326 Geological Techniques — S2 L3T3

Prerequisites: 25.212, 25.311.

Geochemistry: Modern destructive methods of rock and mineral analysis. Non-destructive methods; X-ray fluorescence spectroscopy and electron probe microanalysers.
Geological Surveying: Levels, tacheometers and theodolites. Field techniques. Precision of angular measurements. Stadia surveying. Levelling. Field computations. Closed and open traverses. Coordinates and their computation.
Sedimentology: Properties of sedimentary populations. Sampling practices. Measurement of grain size, grain shape and packing; analyses of measured data. Geological significance of sediment parameters.
Field Mapping: Geological mapping in a complicated geological terrain. Geological report writing and cartography.

25.411 Resource Geology

Geophysics: The planning of geophysical surveys within the context of overall exploration and engineering development programs. Geological interpretation of geophysical data and discussion of selected case studies.

Resource Economics: An 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.

Mineral Exploration: Use of geology in mineral exploration and area selection; principles of exploration geochemistry; radiometric and remote sensing methods, exploration drilling; ore reserve estimation; exploration ground tenure in New South Wales.

Engineering Geology: Rock slope stability analysis and stabilization techniques for mine developments. Ground water control and hydrogeological principles applied to mineral and energy resource development: mine dewatering.

World Evolution: Seminars on the world's geology from varied aspects.

25.412 Mineral and Energy Resources

Students taking this option are expected to show preference for either mineral or energy resources. Projects, lectures, tutorials and seminars are designed accordingly.

Mineral Resources: A major part is a student field-laboratory research project in some aspect of mineral resources. This may be a general geological project, or a specialised mineral exploration project, eg, geochemical, geophysical, mineralogical, etc. During the first session only there are additional lectures/seminars that follow on from 25.411 to give more detailed appreciation of various aspects of mineral resources and include exploration management, mine evaluation, exploration geochemistry, exploration geophysics and mathematical geology. The content and extent of tuition in these subjects varies from year to year according to student requirements.

Energy Resources: A major section consists of a field mapping project in a sedimentary terrain. Depending on students' requisites, specialised field/laboratory studies are arranged in sedimentology, macro- and micropalaeontology, palynology, mathematical geology, geophysics and well-log analysis. Where possible, projects are directly related to problems of coal and petroleum occurrence. During the first session attendance is expected at lectures/seminars described in the Mineral Resources section above and of common interest to understanding evaluation and exploitation of energy resources.

25.413 Engineering and Environmental Resources

A major part is a field/laboratory research project in some aspect of engineering or environmental geology. During the first session additional lectures are given on: foundation geology; construction materials; rock weathering and fabric analysis applications to engineering problems; site investigations; practical construction geology; soil slope stability analyses and stabilization; geomechanical principles; engineering geophysical techniques; engineering geological case histories; and advanced geological surveying applied to engineering works.

Old course 3000 subjects.

25.013 Geology IIIA

Prerequisites: 2.121, 2.131, 25.012, 25.022.

Economic Geology A: Principles and theories of ore formation. Magmatic, hydrothermal, submarine exhalative ore, and vulcanicity. Ore deposits and modern global tectonics. Biogenic processes, sedimentary ore deposits. Alluvial and residual deposits. Description of specific deposits illustrating various types of mineralization.

Laboratory: Hand specimen study of ores and associated features; introductory mineragraphy.

Mineralogy and Petrology

Mineralogy: Further optical crystallography; determination of refractive indices. Laboratory methods of mineral separation. Principles of X-ray diffraction; simple application of X-ray powder cameras and diffractometers.

Igneous Petrology: Igneous activity at convergent and divergent plate boundaries. High pressure and low pressure fractionation. Influence of H_2O, CO_2 and O_2 on melting relationships. Primary magmas. Magmatic lineages. Mantle inhomogeneity. Significance of trace element and isotope studies.

Sedimentary Petrology: The influence of transportation, deposition and diagenesis on the composition, texture and structure of detrital sedimentary rocks including limestones. The classification of the detrital sedimentary rocks. The chemically formed sedimentary rocks including the phosphates, zeolites, evaporites, ferruginous and siliceous deposits. Introduction to coal petrology.

25.023 Geology IIIB

Prerequisites: 2.121, 2.131, 25.012, 25.022.

Geophysics

Global Geophysics: The physics, shape, structure and constitution of the earth seismology, gravity, geology, geothermy, geomagnetism, palaeomagnetism, geo-electricity and geochronology. Geotectonics and geodynamics: geophysical expression and relation to geology and geochemistry. *Exploration Geophysics:* Covering the following methods seismic, electrical, electromagnetic, gravity, magnetic and radioactive with applications for mining, petroleum, engineering, hydrology and well logging.

Stratigraphy and Palaeontology

Stratigraphy: Theoretical stratigraphy including stratigraphic classification, reference points and stratotypes, correlation by fossil zones and physical methods. Continental margins, mobile zones, with a detailed study of the New England Fold Belt. Comparison between mobile zones and intracratonic basins. Intracratonic basins of Western and Southern Australia and effects of the dispersal of Gondwanaland. Mesozoic to Recent sedimentation in Papua New Guinea. Stratigraphic and structural development of aulacogenes. *Palaeontology:* Principles of systematics. Theory of evolution. Functional morphology and biostratigraphic significance of arthropods, echinoderms and graptolites. Introduction to Palaeobotany. Practical applications of palaeontology.

Field Mapping

Geological mapping in a complicated geological terrain with emphasis on stratigraphical and structural interpretation. Geological report writing and cartography.

25.033 Geology IIIC

Co-requisites: 25.013, 25.023.

Mathematical Geology and Geological Surveying

Mathematical Geology: Mathematical techniques and concepts which may be applied to the analysis of geological data. Measurement scale, probability axioms, frequency analysis and basic geostatistics. Sampling theory and techniques. FORTRAN computer programming forms a substantial part of the course with programming exercises in the analysis of map information and other geological data. Quantitative map interpretation with emphasis on trend surface analysis and automatic contouring techniques.

Geological Surveying: Levels, tacheometers and theodolites. Field techniques. Precision of angular measurements. Stadia surveying. Levelling. Field computations. Topographic maps.

Geochemistry and Petrology

Geochemistry: Some modern methods of rock and mineral analysis. Accuracy, precision and quality of geochemical data. The distribution of elements in terrestrial rocks. Norms.

Clay Mineralogy: The structures and properties of the clay mineral 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.

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.

Practice: Macroscopic and microscopic study of ingneous and metamorphic rocks.

Advanced Structural Geology

Analysis of structural elements at the microscopic, mesoscopic and macroscopic scales. Modern methods of analysis, especially petrofabric analysis and A.V.A. Detailed studies of the analysis of metamorphic terrains, e.g. Otago Schists; Cooma Complex.

Sedimentary Basin Analysis and Geology of Hydrocarbons

Basin evolution. Analysis of sedimentary and palaeoecological systems in fluvial deltaic, nearshore and deepwater environments. Structural

systems formed by tensional, compressional and strike-slip tectonics. Geochemistry of hydrocarbons and formation fluids. Factors critical to occurrence of oil, gas and coal. Typical Australian and overseas occurrences. Techniques of exploration, assessment and development of reserves.

Field Mapping and Remote Sensing

Field Mapping: Field mapping in a complex geological terrain, with concentration on the structural geology of deformed and metamorphosed sequences. Writing geological reports, and drafting geological maps.

Remote Sensing: Exercises in the combined usage of air photos and ERTS imagery for the interpretation of regional and structural geology.

In addition, one of the following topics are selected after consultation with the Head of School:

1. *Economic Geology B, Mineragraphy, Experimental Petrology*

Economic Geology B: Detailed study of selected major deposits representing particular types of mineralization — geological setting, petrology, mineralogy and genetic aspects. Experimental work in ore genesis — isotope studies, trace elements, phase equilibria, inclusions in minerals.

Mineragraphy: Reflected light optics: orthoscopic and conoscopic rotation phenomena, determinative methods, textural interpretation of ores.

Experimental Petrology: Theoretical Petrology. Phase diagrams. Application of thermodynamics to petrological problems. Experimental petrology.

Laboratory: Economic Geology and Mineragraphy: Study of regional setting, current research, petrology and mineragraphy of selected deposits dealt with in lectures.

2. *Micropalaeontology*

Morphology, stratigraphic distribution and significance of the principal microfossil groups: foraminifera, ostracoda, conodonts, spores and pollen, dinoflagellates, coccoliths and chitinozoa. Extraction techniques.

3. *Surficial Geology*

Processes — weathering and landforms, mass movement, gully and sheet erosion. Fluvial processes and drainage development. Aeolian, glacial, periglacial and coastal processes. Neotectonics. Soil and surficial sediment evaluation — pedological processes, gilgai formation. Soil fabric analysis at all scales. Principles of surficial stratigraphy.

Map analysis and preparation — contour patterns of landforms; geological and geomorphic interpretation of topographic maps. Soil classification, soil map preparation, lithogeomorphic maps. Problems of mapping Quaternary geology.

Quaternary geology — methods of dating, sea level change, glacial sequences, surficial geology of non-glaciated areas of Australia — especially the Riverine Plain. Quaternary sequences in Canada and Europe.

25.014 Geology IV: Advanced Applied Geology

Prerequisites: 25.013, 25.023, 25.033.

Computer Applications in Geology: Advanced methods in mathematical geology, including time series analysis, Markov chain analysis, deterministic simulation of sedimentary processes such as delta formation. Classification procedures including R & Q cluster analysis techniques, factor analysis as applied to facies delineation. A major section of the course is devoted to processing geological data using library programs available on the computer.

Exploration Geophysics: An introductory course in the practice, theory and interpretation of geophysical methods of exploration in petroleum, mineral deposits and engineering geology, extending beyond Exploration Geophysics of Geology III.

Seminar: A weekly participatory activity.

25.024 Geology IV: Project

Prerequisites: 25.013, 25.023, 25.033.

An individual field assignment carried out under supervision and consisting essentially of geological mapping plus supporting laboratory work.

25.034 Geology IV: Engineering Geology

Prerequisites: 25.013, 25.023, 25.033.

Introductory Geomechanics: Engineering classification behaviour, and tests of rocks and soils. Stress and strain: elasticity and plasticity, stress distribution in virgin rock masses, about excavations, and beneath foundations.

Hydrogeology: Hydrological cycle; aquifers: fluid flow in rocks and soils; hydraulic properties of rock. Hydrogeological mapping and maps. Pollution of groundwater. Arid zone hydrology.

Environmental Geology: Geology in urban development and regional planning. Terrain evaluation, with special reference to beaches. Rehabilitation.

Site and Material Investigations: Methods and field tests. Petrography, physical and chemical properties of concrete aggregates, road and earth construction materials. Quarry sites and borrow areas.

Engineering Geology: Geology in civil engineering investigations. Geological factors in the design and construction of various civil engineering undertakings. Stability of slopes and open cuts.

Geological Surveying: Triangulation. Closed and open traverses. Co-ordinates and their computation. Plane tabling. Hydrographic surveying. Mine surveying. Principles of cartographic and map projections. Principles of photogrammetry.

25.044 Geology IV: Mineral Exploration

Prerequisites: 25.013, 25.023, 25.033. Co-requisites: 7.023.

Mineral Exploration: Theory and application of exploration techniques, including geochemical prospecting and soil-gas geochemistry; remote sensing and radiometric surveys. Geological appraisal, exploratory drilling. "Proving" ore discoveries. Cost factors in exploration.

Geochemistry: Sampling and sample preparation. Principles of the analysis of silicate rocks by X-ray fluorescence spectrometry; accuracy and precision. Acquisition and interpretation of geochemical data. A field and laboratory project is an essential; part of the course.

Students taking this option are required to take 7.023.

25.054 Geology IV: Sedimentary Basins

Prerequisites: 25.013, 25.023, 25.033.

Lectures, tutorials and a laboratory project in Advanced Sedimentology, Palaeontology, Palaeoecology and Petroleum Geology.

25.064 Geology IV: Applied Geophysics

Prerequisites: 25.013, 25.023, 25.033.

Exploration and applied geophysics, its practice, theory and interpretation in petroleum, mining and engineering exploration and in applied geology.

25.074 Special Project

A field-laboratory project related to the option selected by the student.

Other Geology subjects

25.332 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 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 classification. *Metamorphic Rocks:* metamorphic processes and metamorphic structures, classification and description of metamorphic rocks. Phyical 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 speciments.

Field Tutorials: Two field tutorials are conducted at which attendance is compulsory. Satisfactory reports must be submitted.

Note: Total hours: 56. The course is divided equally between lectures and laboratory work. Field Tutorial hours are additional.

25.521 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.

25.532 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.

25.541 Mineralogy (Applied Science Course)

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, paragenesis, 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.

25.112R Geology for Mining Engineers IIA

Prerequisite: 25.520.

Elements of stratigraphy, palaeontology and petrology. Environemnts 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.

25.122R 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. Occurrence 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 Mineragrahic Laboratory Work

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

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.

Servicing Subjects

25.621 Marine Geology I

25.622 Hydrological and Coastal Surveying

25.631 Marine Geology II

25.632 Estuarine Geology

25.634 Marine Mineral Deposits and Exploration

25.635 Marine Resources

Graduate Study

25.331G Applied Geophysics I

Seismic Methods: The theory, interpretation, application and practice of seismic exploration. Seismic ray theory: the propagation, reflection and refraction of seismic waves. Analysis of seismic records and the interpretation of seismic travel-time data in terms of depths and velocities of the layers with plane and regular interfaces. Seismic sources and recording systems in marine and land applications. Basic instrumental, field and computing techniques of signal enhancement. Synthetic seismograms. Geological interpretation in petroleum engineering and other applications and case histories.

Electrical Methods: Introduction to galvanic and electromagnetic methods in geophysics with applications to mineral, groundwater and other engineering applications. Electrical properties of rocks and minerals. Quantitative interpretation of conduction methods. Electrochemical mechanisms of spontaneous and induced polarization effects. The effect of electrode arrays in galvanic methods. Time and frequency domain equivalents in induced polarization and electro-magnetic methods. Theory of electromagnetic induction and electro-magnetic induction methods: Natural and applied electromagnetic field methods, including audio-frequency, magneto-telluric, continuous wave and transient systems in ground and airborne applications. Basic

instrumentation and field procedures. Qualitative and quantitative interpretation of the above techniques; their interrelation and integration with other geophysical methods in exploration and their geological interpretation.

Gravity and Magnetic Methods: Field procedures, instrumentation, measurement and reduction in gravity and magnetic methods. Relevant physical properties of rocks and minerals. Introduction to potential theory, Laplace and Poisson equations, and their application in geophysical exploration. Spherical harmonics. Continuations and second derivatives of potential fields and introductory filter theory. Interpretation of anomalies due to distributions having simple geometrical shapes and two and three dimensional distributions of arbitrary shapes. Determination of depths and the qualitative interpretation of aeromagnetic surveys. Case histories and applications in petroleum and mineral exploration.

Radioactive, Thermal and Other Ancillary Methods in Ground and Airborne Remote Sensing Applications: The application of geophysical techniques to bore-hold logging in petroleum engineering and mineral exploration.

25.333G Applied Geophysics IIA

A more advanced treatment of seismic, electrical, electromagnetic, gravity and magnetic methods of geophysical exploration.

Seismic: Wave theory and the propagation of elastic waves in continuous, layered and in homogenous media; direct, reflected, refracted, surface and guided waves. Interpretation techniques with variable velocity conditions. Advanced computer processing of seismic data and specialized instrumental, field and computer techniques of signal/noise improvement and data enhancement. Further geological interpretation in petroleum and engineering applications. *In situ* and laboratory determination of elastic properties of rocks.

Electrical Methods: A more advanced treatment of galvanic and inductive methods of geophysical exploration. Analog and digital modelling and interpretation in galvanic and inductive methods. Considerations of design and application of various electrical methods to geological problems: geological interpretation of electrical and other integrated geophysical methods in exploration.

Magnetic and Gravity Methods: An advanced treatment of filter theory in potential methods: the design and use of specific filters on data reduction. Further treatment of the interpretation of potential field anomalies due to two and three dimensional distributions. Computer applications in the reduction, processing and interpretation of magnetic and gravity data. Geological interpretation of geophysical potential field data.

A More Advanced Treatment of Radioactive and Thermal Remote Sensing Tecniques, and of Downhole Geophysical Methods: Practical interpretation of well log data.

25.335G Applied Geophysics Project Assignment

A project involving interpretation of geophysical field data which may be collected by the students.

25.337G Geophysical Procedures

Selection of geophysical methods, field procedures, features and limitations of geophysical methods, interpretation of results, the place of geophysical methods in integrated exploration programs, geophysical case histories, costs and logistics.

25.338G Computer Applications in Exploration and Mining Geology

Probabilistic approaches to regional exploration and target area delineation; systems approach to exploration planning; drilling patterns and intersection probability; computerized ore reserve computation; optimum mine design and discounted cash flow analysis.

25.339G Geology in Exploration

Ore genesis theories in exploration, ore environments, ore environment extrapolation in time and space, synthesis in exploration, regional patterns of ore occurrence in relation to modern tectonic theory, guides to mineralization. Evaluation of outcrops and size and depth predictions. Geology and evaluation of detrital deposits and of non-metallic deposits.

25.340G Geochemical Prospecting

Review of geochemical methods; geochemical prospecting as related to types of mineralization, topography and climate; soil, rock and soil gas geochemistry; stream and stream sediment geochemistry; airborne methods; biogeochemical and geobotanical prospecting; geochemical case histories, costs and logistics.

25.341G Remote Sensing

The electromagnetic spectrum and the physics of remote sensing, active and passive sensing, conventional photography in exploration, black and white and colour infra-red photography in exploration, low sun-angle photography, side-looking air radar, gamma ray spectrometry, thermography, ERTS, case histories in remote sensing.

25.343G Mineral Economics, Leasing Law and Management

Principles of mineral economics, metal prices, price fluctuations, imports and exports, policy formulation by companies and by governments; mining law in Australia with special reference to land tenure and lease acquisition; organizing and managing a mineral exploration venture, personnel management.

25.344G Field and Laboratory Methods in Exploration

Tutorials and demonstrations both in the field and the laboratory in the use of various instruments relevant to mineral exploration. The work in this subject is directed particularly, but not exclusively, toward the Field Project.

25.402G 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.

25.403G 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.

25.404G Environmental Geology S1 L1½T1½

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 uesd 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.

25.405G 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, electromagnetic and gravity methods as applied; to engineering problems. Geophysical well logging: resistivity, self-potential, gamma ray and sonic logs applied to determination of rock properties and location of clay-filled joints.

Field tutorials: Short field tutorials are included.

25.406G 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 classificaiton of rocks. Rock mechanics testing procedures.

25.407G Geopollution Management S1 L1½T1½

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.

25.408G Engineering Geology S1 L2T1

Co-requisite: 25.406G.

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.

Several field tutorials form part of this subject.

25.409G Foundation Geology S1 L1½T1½

Co-requisite: 25.406G.

Foundation principles: investigation, design, construction. Improving rock and soil. Geology of dam, road, airfield, bridge and building foundations. Geology of tunnels and large underground openings. Foundations on unstable landforms and in seismically active regions.

25.410G Coastal Environmental Geology S1 L1½T1½

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.

School of Geography

Undergraduate Study

27.111 Applied Physical Geography I F L2T4

Prerequisite:

	HSC Exam Percentile Range Required
2 unit Geography	*71-100*
or	
3 unit Geography	*31-100*

or	
2 unit Science (any strand)	*31-100*
or	
4 unit Science (multistrand)	*31-100*
or	
2 unit Mathematics	*71-100*
or	
3 unit Mathematics	*31-100*
or	
4 unit Mathematics	*11-100*

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.

27.112 Applied Physical Geography II — F L2T3

Relationships and interactions between atmosphere, water, land and biota, and the impact of man in accelerating change within the physical landscape.

Climatic aspects of catchment hydrology and water resources. Analysis of climatic data for quantifying variability and the probability of extreme weather conditions producing natural hazards of floods, droughts and destructive winds. Evaluation of climatic elements affecting weathering and erosion potential. Topographic controls of local climate. Drainage basin morphometry, dynamics and function, including hillslope hydrology and geometry, and controls of runoff and sediment transport. Soil genesis in Australia including soil stratigraphy and periodicity. Soil and environmental properties in relation to hydrology and plant growth.

The ecosystem model and hypotheses as to the nature of the plant community. Biogeochemical cycles. Effects of disturbance on energy and nutrient flow within ecosystems. Study of selected habitats — their composition, structure and environmental controls. Man's impact upon climate, soils, hydrologic conditions, landforms and the habitats of plants and animals. Climatic change and its effect upon the character of landforms, soils and vegetation.

27.114 Land Resources Management† — S1 L2T2

Methods of assessment of resources and of natural and man-made environments. Land capability and conservational management. Assessment of risk from natural hazards and investigational procedures relating to community and governmental perception and response. Assessment of man-made environmental problems. Remote sensing and other data sources for resource management. Emphasis is placed on case studies, the preparation of assessment statements and reports, and to the significance of cost-benefit analysis for such investigations.

27.133 Pedology — S2 L2T3

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.

27.143 Biogeography — S1 L2T3

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.

27.153 Climatology — S2 L2T3

Physical bases for understanding microclimate. Processes of energy exchange at the earth's surface, and the atmospheric and terrestrial surface controls of the heat and mass budgets. Atmospheric diffusion. Wind profiles and atmospheric turbulence as affected by stability and surface properties. Determinants of the local and site-specific climatic environment, particularly topographic, surface cover and substrate conditions. Urban climate and climate in relation to human comfort and health. Building and constructional design aspects of climate and applications of climatology in urban and regional planning. Climatic aspects of the development and utilization of solar and wind energy sources.

27.163 Methods in Physical Geography — F L½T1

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.

27.172 Environmental Measurements — F L½T1

Observation, measurement and recording of climatic variables. Statistical qualities of data representing the various climatic elements. Collection and summary of climatic data. Tests for spatial and temporal homogeneity in climatic records. Maintenance of climate stations. Network densities in relation to spatial variation in climatic elements. Use of air photographs and maps for collection of topographic data and

†Offered subject to availability of staff.

identification and mapping of land systems. Methods of field surveying. Instrumentation for the study of geomorphic and hydrologic processes. Soil profile description and preparation of soil maps from field data. Collection of soil samples and field measurement of soil properties, including infiltration, water content and thermal conditions. Measurement and description of vegetation. Vegetation survey, sampling and species abundance measures. Sampling strategy in biogeographical studies.

27.173 Remote Sensing Applications† S2 L1T2

Principles and technical aspects of remote sensing. Forms of available imagery, their utility and facilities for their interpretation. Application of remote sensing for the assessment and mapping of land properties, resources and land use. Applications in resource and environmental management.

27.183 Geomorphology S1 L2T3

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.

27.234 Applied Geomorphology and Pedology S1 L4T4

Methods of classifying and mapping soils and related land-surface elements. Runoff processes, movement of water through the soil, and physiographic factors in catchment hydrology and flooding. Problems of the stability of slopes and soils, and related investigational methods. Factors affecting denudation and accelerated erosion, measurement of processes, and methods of control. These studies are applied in both natural and urban environments. Supporting field and laboratory studies.

27.344 Applied Biogeography and Bioclimatology S1 L4T4

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. Energy and mass budgets of distinctive plant communities, and the aerial and soil microclimate of plant and animal habitats. Climatic aspects of disease infection and insect populations. Quantitative models for biometeorological forecasts and assessments of biological productivity and phenology using normally available climatic data. Conservation of ecosystems. Biogeographic principles of reserve planning. Exploitation of populations and population characteristics in pest control strategy. Organisms as indicators of environmental quality.

27.504 Projects in Applied Geography

Biogeography and 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 and 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 L2T4/L2T1

Prerequisite:

	HSC Exam Percentile Range Required
2 unit Geography	*71-100*
or	
3 unit Geography	*31-100*
or	
2 unit Economics	*71-100*
or	
3 unit Economics	*31-100*
or	
2 unit Mathematics	*71-100*
or	
3 unit Mathematics	*31-100*
or	
4 unit Mathematics	*11-100*

Emphasis is on basic concepts, themes and issues in economic geography. Topics include: spatial interaction and analysis of movement patterns; location principles; the organization of settlement patterns and the space economy; behavioural and decision-making processes. Australian case studies are stressed. Laboratory classes deal with handling and presentation of data in economic geography.

27.612 Applied Economic Geography IIA S2 L2T4

Theoretical principles underlying the location of the firm and the spatial organization of land use are emphasized. Topics include: factor costs and the location problem; demand, scale and agglomeration; rent theory and location patterns; location decisions under conditions of uncertainty; linear models in location analysis.

27.613 Applied Economic Geography III F L2T2

Problems and approaches to mathematical model building for spatial analysis including: Location-allocation models, diffusion models, transport and interact models, and land-use models.

†Offered subject to availability of staff.

27.622 Applied Economic Geography IIB S1 L2T4

Focus is on processes of change in urban and regional systems. Topics include: the spatial distribution of economic activities; the economic structure of cities and regions; regional linkages and the transmission of economic change; input-output analysis; urban and regional growth and decline; concentration and dispersion of economic activities; regional disparities; policy issues in urban and regional development. Laboratory classes include methods of urban and regional analysis and an introduction to regional forecasting.

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.

27.631 Geographic Data Analysis I S2 L1T3

Emphasis is on a variety of methods for measuring spatial associations and relationships within a hypothesis-testing framework. Laboratory work is based on the use of S.P.S.S. procedures.

27.632 Geographic Data Analysis II F L1T2

Focus is on inferential problems in the analysis of location patterns and the application of multivariate methods in economic geography, particularly multiple regression and factor analysis. Laboratory work is based on the use of the CYBER and FORTRAN language with particular reference to geographical information systems.

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.

27.642 Mathematical Methods for Spatial Analysis F L1T2

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 source material and published statistics of relevance to Economic Geographers; problems of geocoding and spatial identifiers; coding information and data banks; and automated cartography. Project work in the development of information systems for monitoring spatial change.

27.662 Urban Systems S1 L2T2

The exploration of concepts relating to the city as a complex system with emphasis on spatial structure and processes and change in the spatial organisation of urban areas. Particular emphasis is on industrial location, residential development, population distributions, and service provision.

27.713 Marketing Geography* S2 L2T2

Spatial reality as a result of consumer and producer decisions. The relationship between consumer spatial behaviour and the pattern and structure of marketing establishments. Organisation 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 L2T2

The analysis of the transportation system in terms of its relationship with economic and geographical indicators. Focus on network analysis, flow studies, modal systems, circulation theory, impact studies, transport and economic development, and the urban transport problem. Laboratory classes involve practical application of pertinent methodology, while seminars stress the consideration of major problem areas in transportation in Australia.

27.733 Regional Policy and Planning* S1 L2T2

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* S1 L2T2

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.

*Offered subject to availability of staff.

27.753 Social Welfare and Urban Development* **S1 L2T2**

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.

27.763 Rural Resource Problems* **S2 L2T2**

Structural adjustment in agriculture; government intervention; rural land subdivision; competing uses for rural land; conservation/development conflicts; the future of country towns; depressed rural regions as poles of underdevelopment; economic and social organisations — family farms, agribusiness, village co-operatives and farm tourism; integrated rural planning initiatives. Emphasis on Australian cases with international experience as context. Workshops to emphasise planning applications.

27.773 Spatial Aspects of the Housing Market* **S2 L2T2**

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 L2T2**

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.

27.793 Models of Spatial Systems* **S2 L2T2**

The design and development of models of spatial systems, including: Entropy maximisation methods; control theory; evaluation of alternative models; and case studies of models in urban and regional analysis.

Servicing Subjects

27.295 Physical Geography for Surveyors **S1 L2T2**
27.801 Introduction to Physical Geography
27.802 Introduction to Human Geography
27.811 Physical Geography
27.812 Human Geography
27.813 Geographic Methods
27.824 Spatial Population Analysis
27.825 Urban Activity Systems
27.826 Urban and Regional Development
27.834 Spatial Population Analysis (Advanced)
27.835 Urban Activity Systems (Advanced)
27.836 Urban and Regional Development (Advanced)
27.412 Coastal Geomorphology
27.860 Landform Studies
27.862 Australian Environment and Natural Resources
27.863 Ecosystems and Man
27.870 Landform Studies (Advanced)
27.872 Australian Environment and Natural Resources (Advanced)
27.880 Advanced Geographic Methods
27.890 Thesis and Associated Seminars
27.893 Honours Physical Geography
27.894 Honours Urban Geography
27.895 Honours Social Geography

Graduate Study

27.901G Geomorphology for Hydrologists **S2 L1½T1½**

Geomorphological controls in the initiation of drainage systems. Drainage networks as geomorphological systems. Types of drainage channel. River floodplains and terraces. Drainage systems of arid regions. Geomorphology of representative basins and vigil catchments. Geomorphology in the assessment of water resources. Landforms produced by underground water. Airphoto and map analysis of drainage features and map and field study of a vigil catchment.

27.902G Meteorological and Hydrological Principles **S2 L3T0**

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.

*Offered subject to availability of staff.

27.904G Geomorphology for Engineering Geologists† S2 L1½T1½

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.

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. The nature and scope of behavioural science; culture; social institutions; groups; social class; interpersonal and mass media communication; learning; perception; personality.

28.042 Consumer Behaviour

Prerequisite: 28.032

The specific sociological and psychological topics in Behavioural Science are applied to the problem of understanding the consumer in the marketing context. The following areas are covered: motivation and arousal; consumer behaviour as a decision process; problem recognition; search behaviour; choice behaviour; purchasing processes; post-purchase behaviour.

School of Marketing

Undergraduate Study

28.012 Marketing Systems

A conceptual introduction to marketing from the systems viewpoint. Discusses the 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 the 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.

28.022 Marketing Models

Quantitative analysis in marketing decision-making in business situations. The derivative (pricing for profit maximization, inventory policy for cost minimization); linear programming (designing programs to maximize profits); techniques of planning (product launch using PERT); probability competitive bidding theory; market decision-making under conditions of uncertainty; assignment algorithm (allocation of salesmen to territories); physical distribution (total system costing, etc.)

The program is designed to provide students with the opportunity to develop their ability to apply quantitative methods to practical marketing problems.

School of Surveying

Undergraduate Study

29.441 Surveying for Engineers S1 or S2 L2T4

Coordinate 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 surveys, engineering and underground surveys. Outline of photogrammetry.

29.491 Survey Camp

A one-week field camp for students studying 29.441 Surveying for Engineers.

†Offered subject to availability of staff.

Department of Organizational Behaviour

Undergraduate Study

30.043 Societal and Organizational Change S2 L1T2

Prerequisites: 14.542, 15.526, 15.052, 15.062, 28.012.

Social change in Australia from an institutional and organizational perspective. Emphasises the interaction of scientific, technological, political, economic, kinship and other institutions and the role played in this process by complex organizations. Among the themes and topics covered are: the nature of social institutions with some Australian examples; the dynamics of institutional and organizational conflict and change; changing values and their impact on organizations; organizational responses to changing environments. Special topics: ideologies of work and leisure, employment and unemployment, public and private sector organizations, analysis of consequences of change for the individual and society.

School of Town Planning

Undergraduate Study

36.411 Town Planning

The urban planning process. Appearance of cities. Historical outline of cities. Levels of planning and types of plans. Ecological land use planning. Regional planning. Metropolitan planning. Neighbourhood planning. Planning law and administration. Social objectives in planning. Environmental impact assessment. Aspects of housing, new towns, the city centre, transportation. Futuristic concepts.

School of Food Technology

Undergraduate Study

38.121 Food and Man S2 L3T3

Prerequisites: 2.121, 2.131, 17.031, 17.021, 41.101, 44.143.

Introduction to food in history, food preservation and human nutrition. Foods of affluent and developing countries; world food trade. Australian and world food agencies. *Food Chemistry:* Nature and occurrence of carbohydrates, proteins, lipids, vitamins, minerals and other constituents of foods of plant and animal origin. *Human Nutrition:* Role of nutrients in human structure and function. Recommended daily allowances, food groups, tables of food composition. Nutritional information, consumer needs and food standards. *Microbes and Food:* The beneficial and deleterious consequences of microbial/food associations. Food hygiene, principles of public health. *Aesthetic and Social Aspects of Foods:* Parameters of food quality; perception and assessment of colour, taste, odour, texture by sensory and instrumental techniques. Food choice and social behaviour; food prejudices, taboos, fads and fallacies; food and society.

Inspection of bulk food handling facilities in areas of horticultural products, milk, meat and eggs; assessment of modern food retailing systems; quality and nutritional assessment of foods by instrumental and panel techniques.

38.131 Principles of Food Preservation S1 L4

Prerequisite: 38.121.

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. Technology of juice and beverage production. 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 and wastewater.

38.132 Plant Food Science S1 L3

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; 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.

38.133 Animal Food Science — S2 L2

Prerequisites: 2.002A, 2.002B, 2.002D, 38.121.

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 teleostian and elasmorbranch 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

Co-requisites: 38.131, 38.132, 38.133, 38.331, 38.431, 38.531.

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, 38.431 and 38.531. 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. Includes metropolitan factory inspections and a field excursion of one week to food production, processing and research organizations in Northern N.S.W. and Queensland.

38.140 Food Technology Project — T8

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 L4

Prerequisites: 2.043L, 38.131, 38.132, 38.133, 38.134, 38.331, 38.531.

Food legislation: State and NH&MRC food standards and mechanisms; Codex standards; case studies in food standards development; food and nutrition policy.

Process control: revision of statistics, mean, variance, test of hypotheses, sample procedures; measurement of residence time distribution curves.

Pest control: creation of pest problems; techniques of pest control; effects of control measures on environment.

Non-microbial hazards in foods: definition; types of compounds that can be found in food and their effect on man; foods in which toxicants are found; methods of inactivation.

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.

38.142 Oenology — L1T2

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 procedures, maturation and storage, stabilization and clarification, bottling, packaging, and distribution; wine types and composition; quality assessement; 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 — S2 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 L1½T1½

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.

38.147 Food Quality Assessment — S2 L2

Prerequisite: 38.141.

Characteristics of food quality: colour, its instrumental assessment, standards and grades in food products; flavour perception, theories of taste and odour response, the characterisation of food volatiles by GC, IR, MS; texture and consistency of foods, their subjective and objective assessment.

Taste panel methodology: design of questionnaires, environmental conditions, panel selection and training; case studies of several types of taste tests, including consumer surveys; correlation of objective and subjective results of particular foods; masking and synergism of flavours.

38.148 Communications in Food Science and Nutrition — S1 L1T2

Prerequisites: 38.131, 38.132, 38.133, 38.134, 38.331, 38.531.

Sociocultural and psychological basis of attitudes and beliefs in food nutrition and food hygiene. Educational techniques for implementing behavioural and attitudinal change at varying levels of specialization. Skills in preparation and delivery of oral and written presentation, use of instructional media, preparation of audiovisual aids. Planning and evaluation of instructional units.

38.331 Food Microbiology I — S2 L2

Prerequisite: 44.143 or other equivalent introductory Microbiology course.

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, vegetable, 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.

38.431 Food Engineering I — F L3

The basic equations describing the transport of momentum, energy and mass through solids, liquids and gases; engineering thermodynamics, automatic process control; the engineering approach to problem solving; the selection and operation of processing equipment relevant to the food industry.

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.

38.442 Food Engineering II — F L3

Prerequisite: 38.431.

An extension of material introduced in 38.431 Food Engineering I with an emphasis on the analysis of flowsheets of selected food plants; discounted cash flow analysis; plant layout; energy conservation in the food industry.

38.531 Nutrition — S1 L1

Prerequisite: 38.121.

Food consumption patterns of various socio-economic groups. Dietary imbalance; nutritional disorders of affluence including coronary heart disease, obesity, hypertension; problems of undernutrition including protein, energy, mineral and vitamin deficiencies. Nutrition of risk groups, particularly infants, children, pregnant women and the elderly. Effects of food processing on macronutrients and micronutrients, significance within normal mixed diet. Effects of nutrification of foods on human nutritional status.

38.541 Advanced Nutrition — S1 L2T1

Prerequisite: 38.531.

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.

38.542 Special Topics in Nutrition — S2 L1T2

Prerequisite: 38.541.

Detailed review of specific areas of nutrition of current and/or controversial interest including vitamin supplementation; diet and coronary heart disease; treatments for obesity; nutrition and mental development; alternative food cults; the role of dietary fibre; trace mineral nutrition; food additives and hyperkinesis, infant feeding; nutrition of low-income groups.

38.543 Field and Laboratory Methods in Nutrition — S2 L1T2

Prerequisite: 38.541.

Methods of nutritional assessment including anthropometry, energy expenditure, dietary intakes, biochemical assay of nutrients and metabolites in body tissues and fluids. Survey design, data processing and interpretation. Analytical methods for nutrients in foods, including advanced instrumental techniques.

Graduate Study

38.151G Introductory Food Science — S1 L2

Prerequisites or co-requisites: 2.271, 42.211G, 42.212G, or their equivalents.

An introduction to the history of food preservation and human nutrition. Current world food patterns, organisations and trade. Food chemistry and the role of nutrients in human nutrition; elements of food microbiology, food hygiene and public health aspects of foods. Parameters of food quality; food choice and social behaviour; food and society.

38.152G Food Process Laboratory — S1 T6

Co-requisite: 38.154G.

An integrated series of laboratory and pilot plant exercises illustrating the principles and procedures involved in processing 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.

38.154G Food Technology — L6

Co-requisite: 38.151G.

Introduction to food technology. Principles of food preservation. The science and technology of foods of plant and animal origin, their derived products, with reference to biochemical and microbiological aspects. Food spoilage, foods in relation to disease, food additives, food packaging. Waste disposal.

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 — L1

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 cereal strand.

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 marine strand of 38.154G.

World fisheries, oceanographic factors and fish populations. Biochemistry and microbiology of growth, culture, harvesting and post-harvest handling. Cultivation of fish moluscs, 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.

38.159G Food Process Wastes S2L1

Prerequisite or co-requisite: 3.163G.

Microbiological aspects of water quality and waste treatment. Water quality criteria for food processing operations. Origin, composition, treatment, disposal and utilization of food processing wastes. Plant and field inspections.

38.160G Food Quality Assessment L1

The characteristics of food quality. Colour, its subjective and objective assessment, standards and grades in food products. Flavour, the physiology of flavour perception, theories of taste and odour perception, the characterization of food volatiles. Texture and consistency of foods, their subjective and objective assessment. The use of taste panels and evaluation of results. Principles of consumer testing.

38.161G Food Additives and Toxicology L1

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: 38.151G.

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.

38.351G The Microbial Ecology of Foods S2 L2T4

Prerequisites: An introductory course in Microbiology, 38.154G 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 standards.

38.551G Advanced Nutrition S2 L2T1

Prerequisite: 38.151G. Co-requisite: 38.154G.

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 Nutrition Assessment and Analysis S2 L1T2

Co-requisite: 38.551G.

Nutrient assay of foods including bench and instrumental techniques. Human nutritional assessment by anthropometric, dietary and biochemical methods.

38.900G Master of Applied Science Major Project T6

38.901G Master of Applied Science Minor Project T3

Graduate School of the Built Environment

Graduate Study

39.908G Community Noise Control — S2 L1T1

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 transmission through building elements; noise components of environmental impact statements.

School of Biochemistry

Undergraduate Study

41.101 Biochemistry — S1 L4T8

Prerequisites: 17.021, 2.121 and 2.131. 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.

41.102A Biochemistry of Macromolecules — S1 L3T9

Prerequisites: 41.101 and 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 and 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 illustrates the lectures and provides experience in modern biochemical techniques.

41.102C Plant Biochemistry — S2 L2T4

Prerequisites: 41.101 and 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 subject utilizes radioactive isotopes and a number of newer techniques.

41.102D Biosynthesis of Plant Metabolites — S2 L2T4

Prerequisites: 41.101 and 2.002B. Co-requisite: 41.102C.

This unit complements 41.102C and is taken with it. Topics covered: cell wall formation and the synthesis and mobilization of reserve materials; biosynthesis of amino acids, its regulation, and their conversion into non-protein material, eg. alkaloids and cyanogenetic glycosides; aromatic ring formation and the isoprene pathway as a source of rubber, steroids, carotenes and essential oils. Flower pigments and phytoalexins will be discussed briefly.

Practical work, combined with 41.102C illustrates and amplifies the subject and includes a wide range of the latest techniques.

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.

School of Biological Technology

Undergraduate Study

42.102A Biotechnology A — S1 L2T4

Prerequisites: 41.101 and 42.101 or 44.101.

The basic principles involved in the operation of microbial processes on an industrial scale, including: 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. Discussion of the principles involved in microbial processes for chemical, pharmaceutical and food production, microbial waste treatment and environmental control. The laboratory component includes manipulation of microorganisms, laboratory-scale fermenter operation, microbial enzyme isolation, visits to industrial fermentation plants and industrial seminars.

42.102B Biotechnology B — S2 L2T4

Prerequisite: 42.101.

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 will be 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, are major components.

Graduate Study

42.211G Principles of Biology

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

A condensed treatment of biochemistry comprising the following aspects: the elemental and molecular composition of living organisms; the chemistry and roles of the biological elements and molecules; the thermodynamics and enzymatic catalysis of metabolism; catabolic, anabolic, amphibolic and anaplerotic processes, with emphasis on hydrolysis and synthesis of polymers, glycolysis and gluconeogenesis of glucose, 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

A laboratory program in practical biochemistry. The basic instrumentaion and methodology of the biochemist is introduced by practical exercises and demonstrations. A comprehensive treatment of the relevance and applicability of biochemical techniques is covered in tutorials.

42.214G Biotechnology

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 fermentor design; control of the microbial environment involving computer/fermentor interactions. Industrial examples are 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.

School of Botany

Undergraduate Study

43.101 Introductory Genetics — S2 L2T4

Prerequisites: 17.001 or 17.011 and 17.021 or 17.031 and 17.021.

Various aspects of molecular, organismal and population genetics, including: meiotic and non-meiotic recombination, genome variations, mutagens and mutation rates, cytoplasmic inheritance, gene function, genetic code, gene structure, collinearity of polynucleotide and polypeptide, control of gene action, genes and development, population genetics, genetics and improvement of plants and animals.

43.111 Flowering Plants — S1 L2T4

Prerequisites: 17.001 or 17.011 and 17.021 or 17.031 and 17.021.

The vegetative and floral morphology of Angiosperms with special reference to variations in morphology, elements of biological

classification, nomenclature and identification of native plants. Weekend field work is part of the subject.

43.112 Plant Taxonomy* S2 L2T4

Prerequisite: 43.111. Prerequisite or co-requisite: 43.101.

Considers the assessment, analysis and presentation of data for classifying plants both at the specific and supra-specific level with emphasis on vascular plants. Field work is part of the subject.

43.121 Plant Physiology S2 L2T4

Prerequisites: 17.001 or 17.011 and 17.021 or 17.031 and 17.021 and 2.001 or any two (2) units of 2.111, 2.121, 2.131.

The physiology of the whole plant: photosynthesis, inorganic nutrition, transport, translocation, physiology of growth and development, plant growth substances and their application in agriculture.

43.142 Ecology and Environmental Botany* S1 L2T4

Prerequisites: 17.001 or 17.011 and 17.021 or 17.031 and 17.021.

The soil and atmospheric environments in which plants live and the interaction of plants with their environment. Emphasis is placed on the role of environmental sciences in food production. Students are required to attend three week-day field excursions as part of the practical course.

43.162 The Plant Kingdom* S2 L2T4

Prerequisite: 43.111.

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 is part of the subject.

School of Microbiology

Undergraduate Study

44.111 Microbiology F L1T2

The general nature, occurrence and importance of microorganisms. A systematic review of the major groups of microorganisms: the eucaryotic protista (microalgae, protozoa and fungi); procaryotic protista (blue-green algae, '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.

This is a subject for those who do not wish to proceed further in microbiology and who may have less biological and biochemical background than is required for other microbiology courses.

44.143 Microbiology AS S1 L4T6

Prerequisites: 17.031 or 17.011 and 17.021.

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.

School of Sociology

Undergraduate Study

53.001 Introduction to Sociology (Double Unit)

Introduction to major issues in Sociology: **1.** Culture, Society and Institutions; **2.** Social Inequality.

Under these two headings such issues are social control, power, racism, sexism, work and leisure, class distinction, etc. treated both factually and theoretically, are considered as they relate to the situation in Australia and in the developing countries.

*Note: **1.** The subject 43.112 Plant Taxonomy, alternates with 43.162 The Plant Kingdom (43.112 will be given in 1980). **2.** 43.112 Plant Taxonomy and 43.142 Environmental Botany. These units may be taken in either second or third year of the Science course provided that prerequisites have been completed.

School of Education

Undergraduate Study

58.061 Methods of Teaching I — F L1T2

Prerequisite: 58.512. Co-requisite: 58.513.

Application of principles of educational philosophy and educational psychology to learning in sheep and wool technology, eg, a discussion of aims, verbal learning, learning of skills, procedures to assist learning such as lesson planning and the use of audio-visual aids. Methods of teaching special aspects of sheep and wool technology.

58.062 Methods of Teaching II — F L1T2

Prerequisite: 58.061. Co-requisite: 58.514.

An introduction to curriculum theory. The planning of units of work and programming. Evaluation of the outcomes of instruction. A continuation of the methods of teaching special aspects of sheep and wool technology.

58.063 Seminar and Thesis on Educational Issues — F T2

58.512 Introduction to Education — F L2

The subject serves as a basis for study in greater depth of educational psychology, philosophy and theory of education, research methods and sociology of education in succeeding years and shows the contribution of each to the practice of teaching. This contribution is discussed in lectures and seminars and illustrated by school visits which take place at various times throughout the year.

The time allocation for the subject includes 14 hours spent in field work involving the visits to schools.

58.513 Education IA — F L4

Prerequisite: 58.512. Co-requisite: 58.061.

This subject covers Educational Psychology, Philosophy and Theory of Education, Research Methods and Sociology of Education. *Educational Psychology:* The Educational Psychology strand of the subject includes learning, cognition and individual differences. *Philosophy and Theory of Education:* Curriculum theory and curriculum development, theory in education with refernce to educational objectives, and an analysis of values leading to a concept of education. Various concepts within the context of theory and values, such as responsibility and punishment, indoctrination, equality, creativity. *Research Methods in Education:* An introduction to the methods and principles of research in education. Topics emphasize those techniques necessary for the analysis and interpretation of data from educational research designs of both the experimental and survey type, which include simple and multiple correlation and regression, and a detailed treatment of analysis of variance. *Sociology of Education:* The sociology of education. The role of education in Australian society with particular attention to inequality, adolescent groups including a study of deviants and cultural deprivation. A sociological analysis of classroom groups including group interaction, reference group theory and role theory. An analysis of social structure in the secondary school and the school in the local community. A study of teacher groups with particular attention to role and professionalism.

58.514 Education IIA — F L4

Prerequisite: 58.513. Co-requisite: 58.062.

Four options, each of which occupies two hours per week of class time for one session. The options may be chosen from those given below. However, whether a given option is offered depends on the availability of staff in a given year and other options may be added from time to time.

Options in Educational Psychology

Educational Measurement: The purposes and methods of measurement available to the classroom teacher, including the use of standardized tests. The place of Guidance Counsellors in an evaluation program.

Motivation in the Classroom: Observations of various forms of communication in the classroom suggestive of inner needs. Procedures to facilitate awareness of motives and possible methods for satisfying or controlling them.

Personality: Structure and culture; normal and abnormal behaviour; adjustment and readjustment; attitudes and traits; analysis and measurement; a further look at empathy, role playing, and sensitivity training in classroom.

Computer Assisted Instruction: Within the next few years computers will be commonplace in the classroom requiring teachers with new skills and knowledge. The purpose of this option is to provide a foundation for the skill development necessary to use CAI effectively. It involves both theoretical and practical components, the latter using computer terminals located in the School of Education. No prior experience is assumed.

Programmed Instruction: Students develop appropriate skills and knowledge in the field of programmed instruction to enable them to function effectively in the preparation of instructional sequences which are educationally sound. The use of computer assisted instruction, allowing a practical evaluation of its effectiveness. Students co-operate in the preparation and trialling of programmed materials which might contribute to available teaching resources in their area.

Audio-visual Aids: Students discuss psychological concepts such as *attention, novelty* and its determinants, *perception* in relation to the process. This provides a basis for a study of the techniques and equipment involved in the preparation of teaching aids for classroom use. A group project utilizing these skills and knowledge should produce some useful, psychologically-based materials.

Options in Philosophy and Theory of Education

Ethical Theory and Moral Education: The educational implications of the major ethical theories: the structure of ethical theories; educational implications consistent with a given structure; and practicel issues concerned with moral education.

Justification for Teaching: Certain broad aims of education and expectations of teachers; the extent of their justification and their practical possibility. The stated aims of the Wyndham Scheme are then put to the theoretical and practical test, and students are asked to defend the teaching of certain subjects with special reference to science and industrial arts by showing what benefits will be brought to their

pupils. (This option does not duplicate material covered in curriculum and instruction strands.)

Methodology for Criticism: **1.** Develops methods and techniques whereby meaningful discussion of educational issues can take place; **2.** Critical discussion on issues such as: examinations, assessments, schooling, discipline, equality of opportunity, university degrees, authority, curricula, subjects, and indoctrination.

Moral Education in the Schools: What is moral education? How best can it be brought about? Should schools be concerned with moral education? Do schools confuse moral with practical, prudential, religious and even aesthetic issues, and what might be the consequences and implications of this?

Social Philosophy and Education: Some of the main themes in social philosophy, including the social principles of democracy, freedom and authority, constraint, the individual and society, equality of opportunity. The social functions of the school, and the problems of the above concepts within the closed society of the school.

Philosophy of the Curriculum: How is knowledge involved in education? Are there structures of knowledge which could structure the curriculum? What are the connections between knowledge and skill and knowledge and understanding? What is meant by 'integration of the curriculum'? What is at issue between the advocates of specialized versus general education? Should there be a compulsory curriculum? What is the importance of psychological and sociological considerations in the curriculum formation?

The Aims of Education in Theory and Practice: The theories of some influential educationists and some attempts to apply them. Progressive theories and schools, and the de-schooling movement.

Philosophy of Science and the Teaching of Science: Post-'classical' philosophy of science with an emphasis on the work of Kuhn, Lakatos and Feyerabend, and some elements of Karl Popper's work as a background. What is scientific activity? Evaluation of School Science courses, and ways in which they can be improved. The social dimensions of science and recent work on values, goals, purposes in scientific activity, encompassing wide ranging issues from rationality in science; religion and science. Are Marxism and Freudianism scientific enterprises? What bases are there for the 'Science for the People' movement? What influences science in a capitalist society?

Science and Religion in Education: Comparison of religious beliefs with science, the place of science and religion in the school. Do science and religion conflict? Are religious beliefs like scientific beliefs? Are they rational? How can they be supported? Can faith replace reason? Is there a God? Can there be miracles? Has the teaching of religion a place in schools? Should a science teacher avoid disturbing religious belief? Has the teacher a right to argue for a religious or atheistic viewpoint? The problem of evil.

Option in Research Methods in Education

Educational Research: Provides a basis in some depth for applied educational research. It forms a sequence with the research methods strand in 58.513 Education IA.

Options in Sociology of Education

Australian Education Systems: An Historical and Sociological Analysis: The historical development of Australian education and the application of the sociological perspective to investigate whether Australian education systems are meeting the needs of Australian society.

Society Today and Tomorrow: Implications for Education: Some major characteristics of and trends in society, such as urbanization, social change, bureaucratic organization, the counter culture, community vs. association, and work and leisure patterns, with special reference to the ecological situation and to the significance of values and value transfer. Possible curriculum implications and some of the fundamental questions these social issues raise concerning the role education plays in society.

Socio-cultural influences on the Education of Adolescents: The application of the sociological perspective to the education of adolescents.

The Education of Disadvantaged Groups: The education of disadvantaged groups in Australia, in particular women and migrants.

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 **Faculty Information** 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 earlier in this handbook (see **General Information: Financial Assistance to Students**) there are a number of scholarships available to students. What follows is an outline only. Full information may be obtained from the Student Employment and Scholarships Unit, located in 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*	$150 pa	Minimum period of approved degree/combined degree course	Merit in HSC and total family income not exceeding $4000

*Apply to The Secretary, Bursary Endowment Board, Box 460, PO, North Sydney 2060 immediately after sitting for HSC.

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
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
Applied Geology			
Esso Australia Ltd	Up to $600 pa	1 year	Permanent residence in Australia and eligibility for admission to Year 4 or honours year of full-time Applied Science or Science Course in Geology or Geophysics
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 the first or second year of the full-time degree course in Ceramic Engineering
Australian Consolidated Industries Ltd	Up to $600 pa		
The Brick Manufacturers' Association of New South Wales	Up to $900 pa		
The State Brickworks	Up to $900 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent resident status in Australia and eligibility for admission to the first or second year of the full-time degree course in Ceramic Engineering
Wunderlich Limited	Up to $600 pa		

Undergraduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
Chemical Engineering			
Shell Refining (Australia) Pty Ltd	Up to $400 pa		Eligibility for admission to the second year of the full-time course in Chemical Engineering
Dow Chemical (Australia)	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 the second year 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 Fuel Technology
Food Technology			
Bush Boake Allen Pty Ltd	Up to $4000 over 4 years		Permanent residence in Australia and eligibility for admission to the first year of the full-time degree course in Food Technology
Coca-Cola Export Corporation	Up to $1000 pa	1 year renewable for the duration of the course subject to satisfactory progress	Not more than 22 years of age on 1 December preceding the year in which the award commences and eligibility for admission to the full-time degree course in Food Technology
Food Technology Association	Up to $1000 pa		
George Weston Foods Ltd	Up to $4000 over 4 years		
Gillespie/White Wings	Up to $1000 pa		
Fuel Technology			
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 Fuel Technology
Metallurgy			
School of Metallurgy	Up to $500 pa	1 year renewable for the duration of the course subject to satisfactory progress	Eligibility for admission to the first year of the full-time course in Metallurgy or Metallurgical Engineering

Undergradate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
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 the third or fourth year of the full-time degree course in Mining Engineering
Textile Technology			
The Australian Wool Corporation	$2348 or $1523 pa	1 year renewable for the duration of the course subject to satisfactory progress	Permanent residence in Australia and eligibility for admission to the full-time degree course in Textile Technology
Bonds Industries Ltd	Up to $4000 over 4 years		
Bradmill Industries Ltd	Up to $1000 pa		
Wool and Pastoral Sciences			
The Australian Estates Co 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 the full-time degree course in Wool and Pastoral Sciences
The Australian Wool Corporation	$2348 or $1523 pa		
Commercial Banking Company of Sydney Limited	Up to $1000 pa		
Dalgety Australia Limited	Up to $4000 over 4 years		
Merck Sharp & Dohme (Aust) Pty Ltd	Up to $1000 pa		
National Council of Wool Selling Brokers of Australia	Up to $1000 pa		

Graduate Scholarships

Application forms and further information are available from the Student Employment and Scholarships Unit, located in the Chancellery. This unit provides information on additional scholarships which may become available from time to time, mainly from funds provided by organizations sponsoring research projects.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General			
University of New South Wales Research Awards	Living allowance of $4200 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 Registrar by 31 October (30 November in special circumstances)
Commonwealth Postgraduate Research Awards		As above	Applicants must be honours graduates (or equivalent) who will graduate with honours in current academic year, and who are permanent residents in Australia.
Commonwealth Postgraduate Course Awards		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 (in special circumstances applications will be accepted 30 November).
Australian American Educational Foundation Travel Grant*			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 British Council Commonwealth University Interchange Scheme	Cost of travel to UK or other Commonwealth country university		Applicants must be: **1.** University staff on study leave. Applications close with Registrar by 30 November, for visits to commence during ensuing financial year 1 April to 31 March. **2.** Graduate research workers holding research grants. Applications close with Registrar in December for visits to commence during ensuing 1 April to 31 March.
The Caltex Woman Graduate of the Year	$5000 pa 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 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.

*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)			
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 1 October.
Sam Cracknell Memorial	Up to $3000 pa		See above under **Undergraduate Scholarships, General**
Ruth A. Cumming (ESU)	$500-$2000		Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia.
Gowrie Graduate Research	Maximum $2000 pa in Australia, and $2750 if tenable overseas	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.
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	Between 12 to 21 months	Candidates must be either: **1.** Members of the Australian or a State Public Service or semi-government Authority. **2.** 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 30 years of age. Applications close July.
Frank Knox Memorial Fellowships at Harvard University	Stipend of $3800 pa plus tuition fees	1 year, sometimes 2 years	Applicants must be British subjects and Australian citizens, who are graduates or near graduates of an Australian University.
Nuffield Foundation Commonwealth Travelling Fellowships†	Living and travel allowances	1 year	Australian citizens usually between 25 and 35 who are graduates preferably with higher degrees and who have at least a year's teaching or research experience at a university. Applications close by February.

*Application forms must be obtained from the Australian representative of the Fund, Mr L. T. Hinde, Reserve Bank of Australia, Box 3947, GPO, Sydney, NSW 2001. These must be submitted to the Registrar by 24 July.

†Applications to the Secretary, The Nuffield Foundation Australian Advisory Committee, PO Box 783, Canberra City 2601.

Graduate Scholarships (continued)

Donor	Value	Year/s of Tenure	Conditions
General (continued)			
The Rhodes Scholarship**	Approximately £3300-£3600 pa	2 years, may be extended for a third year	Unmarried male and female Australian citizens, between the ages 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 July each year.
Rothmans Fellowships Award‡	$14000 pa	1 year, renewable up to 3 years	The field of study is unrestricted. Applications close early September each year.
Applied Science			
Australian Wool Corporation Research Scholarship in Textile Technology	$4200 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	Applicants must be graduates in textile physics, textile chemistry, or textile engineering or an appropriate discipline in science or engineering
Australian Wool Corporation Research Scholarship in Wool and Pastoral Sciences			Applicants must be graduates in applied science, agricultural science 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 Masters or PhD degree. Applications close by 31 July.

*Application forms from Executive Officer, Australian Meat Research Committee, Box 4129, GPO, Sydney 2001.
**Applications to Mr H. McCredie, Secretary of the NSW Committee, University of Sydney, NSW 2006.
†Applications to The Registrar, or AINSE Private Mail Bag, Sutherland 2232.
‡Applications to The Secretary, Rothmans University Endowment Fund, University of Sydney, NSW 2006.

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.

Undergraduate University Prizes

Donor/Name of Prize	Value $	Awarded for
General		
Sydney Technical College Union Award	50.00 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.
Faculty of Applied Science		
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 Mechanical and Industrial Engineering Chemical Engineering Mining Engineering Textile Technology (Engineering option only)
School of Chemical Engineering		
Abbott Laboratories Pty Ltd	100.00	Bachelor of Engineering degree course in Chemical Engineering — Year 4
Borden Chemical Co (Aust) Pty Ltd	50.00	Best performance in Design and Process Reports in Year 3
Chamber of Manufacturers of New South Wales	15.00	Subject selected by Head of School
Esso Australia Ltd	75.00	Best performance in Year 2 Chemical Engineering
Institution of Chemical Engineers	100.00 and medal	Best performance for the thesis in the final year, or equivalent part-time stage, of the Bachelor of Engineering degree course
The North Shore Gas Co Ltd	40.00	Subject selected by Head of School
The Shell Co of Aust Ltd	100.00	Best performance in Year 3 Chemical Engineering
Simon-Carves Australia	21.00	Best performance in Thermodynamics and Reaction Engineering in Year 3

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
School of Chemical Engineering (continued)		
Western Mining Corporation Ltd	150.00	Best overall performance in 3.036 Chemical Engineering Laboratory I in the Bachelor of Engineering degree course
	150.00	Best overall performance in 3.044 Chemical Engineering Laboratory II in the Bachelor of Engineering degree course
School of Chemical Technology		
Australian Paper Manufacturers Ltd	21.00	Subject selected by Head of School
Chemical Technology Society	30.00	Bachelor of Science degree course in Industrial Chemistry
	20.00	Bachelor of Science degree course in Industrial Chemistry, Years 1 and 2 or Stages 1 to 4
CSR Limited	50.00	Subject within the discipline of Industrial Chemistry, selected by Head of School
Stauffer Australia Limited	50.00	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
Department of Fuel Technology		
Australian Institute of Energy	50.00	For a fuel subject or allied course project
The Shell Co of Aust Ltd	100.00	Subject selected by Head of School

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	100.00	
Australian Institute of Metals	50.00	
Australian Welding Institute	30.00 book order	
Chamber of Manufacturers of New South Wales	15.00	
The Broken Hill Proprietary Co Ltd	50.00	
The Eagle & Globe Steel Co Ltd	50.00	
The Electrolytic Refining and Smelting Co of Australia Ltd	20.00	
Western Mining Corporation Ltd	150.00	Best overall performance in Year 3 full-time (or its equivalent part-time) in the 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	40.00	Subject selected by Head of School
School of Mining Engineering		
Joint Coal Board	100.00	Bachelor of Engineering degree course in Mining Engineering Year 2
	100.00	Bachelor of Engineering degree course in Mining Engineering Year 3
	200.00	Bachelor of Engineering degree course in Mining Engineering — general proficiency throughout the course
Western Mining Corporation Ltd	75.00	Bachelor of Engineering degree course in Mining Engineering — general proficiency throughout the course
	150.00	Best overall performance in Year 3 of Bachelor of Engineering degree course
	150.00	Best overall performance in Year 4 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 Australia — Asuntol Sheep Dip	25.00	General proficiency — Wool and Pastoral Sciences degree course, Years 2 and 3
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
Samuel Clive Graham	50.00	Bachelor of Science degree course in Wool and Pastoral Sciences, Year 4 — Thesis
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
W. S. and L. B. Robinson University College		
Mining Managers Association Broken Hill	70.00	Best overall performance in a complete course
Mining Managers Association	40.00	Three prizes: one for each best pass in any complete stage of the degree courses in, Mechanical Engineering, Mining Engineering, Science respectively
	30.00	Seven Prizes to be awarded in individual subjects selected by the Director

Undergraduate University Prizes (continued)

Donor/Name of Prize	Value $	Awarded for
W. S. and L. B. Robinson University College (continued)		
Western Mining Corporation Limited	150.00	Four prizes to be awarded for best performance in, 7.314R Mineral Process Technology, 7.313R Mineral Processing, 7.214R Mine Economics and Planning, 7.224R Operational Management
Broken Hill Women's Auxiliary of the Australasian Institute of Mining and Metallurgy	30.00	Awarded for meritorious performance in a complete stage of a degree course

Graduate University Prizes

The following table summarizes the graduate prizes awarded by the University.

School of Chemical Engineering		
The Clean Air Society of Australia and New Zealand	100.00	3.381G Atmospheric Pollution and Control, or a subject of an equivalent nature, taken by students in graduate courses in the School of Chemical Engineering

Faculty of Applied Science

Staff

Comprises Schools of Applied Geology, Chemical Engineering, Chemical Technology, Food Technology, Geography, Metallurgy, Mining Engineering, Textile Technology, and Wool and Pastoral Sciences.

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Chairman
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Dante Simon Santea, Dipling *T.I.Iassy*

Electron Microscopist
Vivian Noel Edward Robinson, BSc PhD *W.Aust.*

Officer-in-charge, Drawing Office
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School of Applied Geology

Professor of Geology and Head of School
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Professor of Engineering Geology
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John Roberts, BSc *N.E.*, PhD *W.Aust.*
Bryce Leslie Wood, MSc DSc *Otago*, MAusIMM

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School of Chemical Engineering

Professor of Chemical Engineering and Head of School
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Professor of Chemical Engineering
Vacant

Professor of Fuel Technology
Vacant

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Department of Biological Process Engineering

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Senior Lecturer
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Department of Chemical Engineering

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Oto Zubzanda, DipIng *T.U. Bratislava*

School of Wool and Pastoral Sciences

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Professor of Pastoral Sciences
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Professional Officer
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W.S. and L.B. Robinson University College

Head of Department of Science
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Head of Department of Mining and Mineral Sciences
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Department of Mining and Mineral Sciences

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Ian Lachlan Maclaine-cross, BE *Melb.*, PhD *Monash*, MIEAust, MAIRAH, MSES
Chakravarti Varadachar Madhusudana, BE *Mys.*, ME *I.I.Sc.*, PhD *Monash*, MIEAust

Mining Engineering

Senior Lecturer
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Mineral Science

Senior Lecturer
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Geology

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Kevin David Tuckwell, BSc PhD *N.S.W.*, AMAusIMM

Department of Science

Chemistry

Lecturer
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Senior Tutor
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Mathematics

Senior Lecturer
Zdenek Kviz, DipPhys *Brno*, CSc RerNatDr *Charles*, PhD *Prague*

Lecturers
David Charles Guiney, BSc PhD *Adel.*
Dennis William Trenerry, BSc PhD *Adel.*

Physics

Senior Lecturer
Robert John Stening, MSc *Syd.*, PhD *Qld.*, DipTertEd *N.E.*, MAIP

Lecturer
Kenneth Reid Vost, BSc *Glas.*, MSc *N.S.W.*, AMAusIMM

Fowlers Gap Research Station

Officer-in-Charge
John Alfred Reynolds, BSc PhD *N.S.W.*

The University of New South Wales Kensington Campus 1980

Theatres

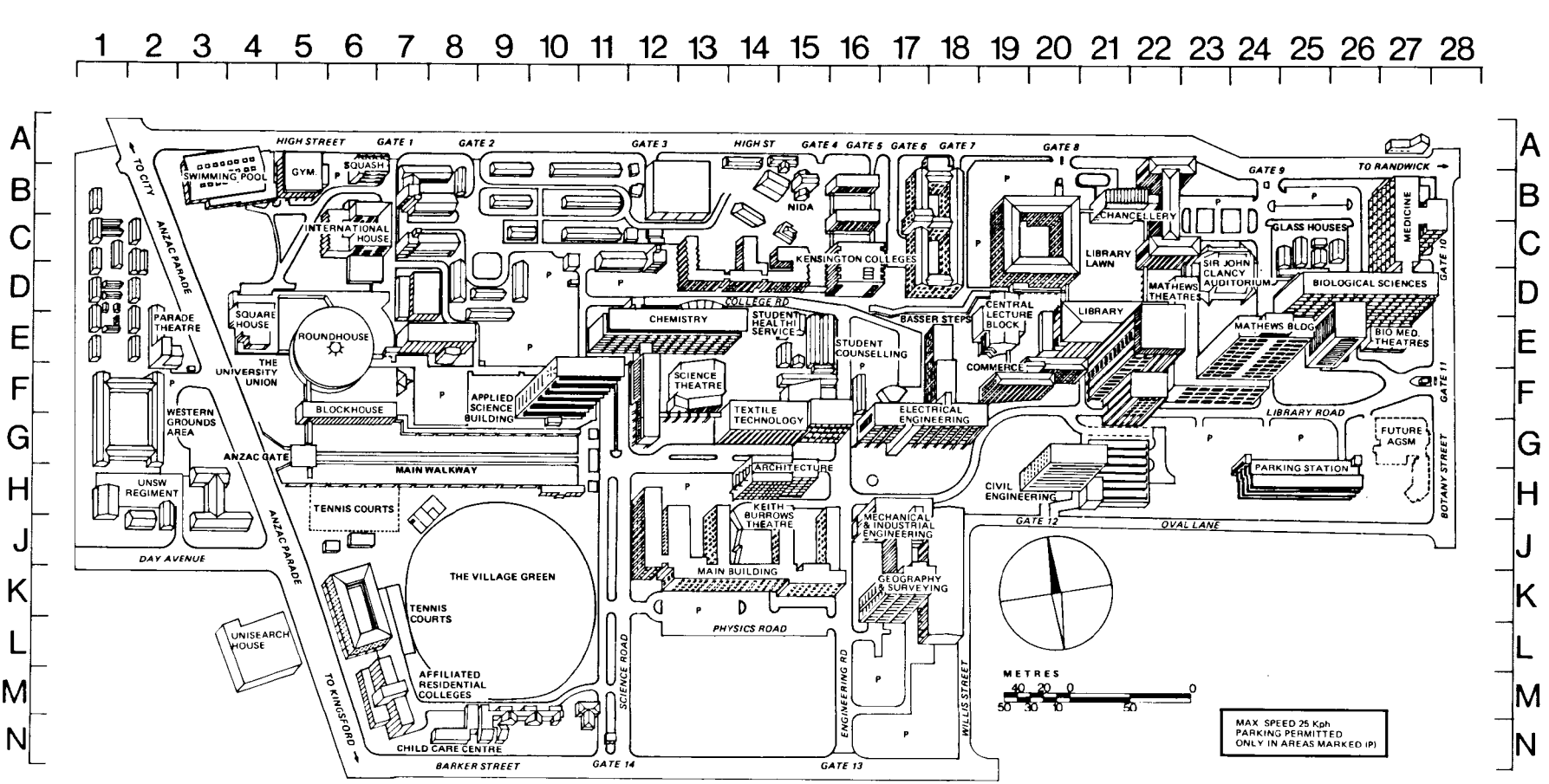
Biomedical Lecture Theatres E27
Central Lecture Block E19
Classroom Block (Western Grounds) H3
Electrical Engineering Theatre F17
Keith Burrows Lecture Theatre J14
Mathews Theatres D23
Old Main Theatrette K14
Parade Theatre E3
Science Theatre F13
Sir John Clancy Auditorium C24

Buildings

Affiliated Residential Colleges
New (Anglican) L6
Shalom (Jewish) N9
Warrane (Roman Catholic) 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
John Goodsell (Commerce) F20
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 (Roman Catholic) M7
Wool and Pastoral Sciences B8

General

Accountancy F20
Admissions Office C22
Anatomy C27
Applied Geology F10
Applied Science (Faculty Office) F10
Appointments Office C22
Architecture
(including Faculty Office) H14
Arts (Faculty Office) C20
Australian Graduate
School of Management F23
Biochemistry D26
Biological Sciences (Faculty Office) D26
Biological Technology D26
Biomedical Library F23
Bookshop G17
Botany D26
Building H14
Cashier's Office C22
Centre for Medical Education
Research and Development C27
Chaplains E15a
Chemical Engineering F10
Chemical Technology F10
Chemistry E12
Child Care Centre N8
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 D9
Economics F20
Education G2
Electrical Engineering G17
Engineering (Faculty Office) K17
English C20
Examinations and Student Records C22
Fees Office C22
Food Technology F10
French C20
General Studies C20
Geography K17
German 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 Languages G14
Institute of Rural Technology B6
Kindergarten *(House at Pooh Corner/*
Child Care Centre) N8
Landscape Architecture H14
Law (Faculty Office) E21
Law Library E21
Librarianship B10
Library E21
Lost Property F20
Marketing F20
Mathematics F23
Mechanical Engineering J17
Medicine (Faculty Office) B27
Metallurgy E8
Microbiology D26
Mining Engineering K15
Music B11
National Institute of Dramatic Art C15
Nuclear Engineering G17
Optometry J12
Organizational Behaviour F20
Pathology C27
Patrol and Cleaning Services F20
Philosophy C20
Physics K15
Physical Education and
Recreation Centre (PERC) B5
Physiology and Pharmacology C27
Political Science C20
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 E1
Sociology C20
Spanish and Latin American Studies C20
Student Amenities and Recreation E15c
Student Counselling and Research E15c
Student Employment C22
Student Health E15
Students' Union E4
Surveying K17
Teachers' College Liaison Office F16
Tertiary Education Research Centre E15d
Textile Technology G14
Town Planning K15
University Union (Blockhouse) G6
Wool and Pastoral Sciences B8
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
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
CHANCELLERY
GLASS HOUSES
MEDICINE
GATE 10
LIBRARY LAWN
SIR JOHN CLANCY AUDITORIUM
MATHEWS THEATRES
BIOLOGICAL SCIENCES
PARADE THEATRE
SQUARE HOUSE
ROUNDHOUSE
THE UNIVERSITY UNION
COLLEGE RD
CHEMISTRY
STUDENT HEALTH SERVICE
BASSER STEPS
CENTRAL LECTURE BLOCK
LIBRARY
MATHEWS BLDG
BIO MED. THEATRES
STUDENT COUNSELLING
COMMERCE
SCIENCE THEATRE
APPLIED SCIENCE BUILDING
TEXTILE TECHNOLOGY
ELECTRICAL ENGINEERING
GATE 11
LIBRARY ROAD
FUTURE AGSM
BLOCKHOUSE
WESTERN GROUNDS AREA
ANZAC GATE
MAIN WALKWAY
ARCHITECTURE
PARKING STATION
BOTANY STREET
UNSW REGIMENT
TENNIS COURTS
KEITH BURROWS THEATRE
MECHANICAL & INDUSTRIAL ENGINEERING
CIVIL ENGINEERING
GATE 12
OVAL LANE
DAY AVENUE
THE VILLAGE GREEN
MAIN BUILDING
GEOGRAPHY & SURVEYING
TENNIS COURTS
PHYSICS ROAD
UNISEARCH HOUSE
TO KINGSFORD
AFFILIATED RESIDENTIAL COLLEGES
SCIENCE ROAD
ENGINEERING RD
WILLIS STREET
METRES
40 20 0 0
50 30 10 50
CHILD CARE CENTRE
BARKER STREET
GATE 14
GATE 13
MAX SPEED 25 Kph
PARKING PERMITTED
ONLY IN AREAS MARKED (P)

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 $3.50 (plus postage and packing, 90 cents). The Handbooks vary in cost. Applied Science, Arts, Commerce, Engineering and Sciences are $2.50. Architecture, Law, Medicine, Professional Studies and AGSM are $1.50. Postage is 40c in each case. The exception is General Studies, which is free.