The University of New South Wales

Applied Science

1976 Faculty Handbook

The University of New South Wales
PO Box 1 Kensington NSW Australia 2033 Phone 6630351

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Contents

General Information

In order to minimize the time and effort that you will put into your study 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. The 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.

Now, see the following sixteen pages for other general information which may be of value to you.

Some people who can help you

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.

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 P. O'Brien, and his Administrative Assistant, Mr S. Briand, are located on the first floor of the Chancellery. They will see students who need advice and who have problems and are not sure whom they should see about them. Mr Briand looks after financial assistance matters. Enquire at room 148A, phone 2482 or 3164.

The Assistant Registrar (Examinations and Student Records), Mr J. Warr, is located on the ground floor of the Chancellery. For particular enquiries regarding *Student Records* (including matters related to *illness affecting study)* contact Mr. B. Newell (phone 2141), and regarding *Examinations,* Mr J. Grigg (phone 2143). This section can also advise on matters relating to *discontinuation of subjects* and *termination of courses.* General enquiries should be directed to 3711.

The Assistant Registrar (Admissions and Higher Degrees), Mr J. Hill, is located on the ground floor of the Chancellery. For particular enquiries regarding *undergraduate courses* phone Mr J. Beauchamp on 3319. General enquiries should be directed to 3711.

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

The Housing Officer, Mrs J. Hay, is located in the Student Amenities and Recreation Unit in Hut B at the foot of Basser Steps. For assistance in obtaining *suitable lodgings* phone 3803.

The Student Health Unit is located in Hut E on College Road. The Director is Dr M. A. Napthali. For *medical aid* phone 2679.

The Student Counselling and Research Unit is located at the foot of Basser Steps. The Head is Mr G. Gray. For assistance with educational or vocational problems ring 2600-2605 for an appointment.

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

The Chaplaincy Centre is located in Hut F at the foot of Basser Steps. For spiritual aid consult Rev B. W. Wilson (Anglican)—2684; Rev Father J. King or Rev Father M. Fallon (Catholic)—2379; Pastor H. Davis (Church of Christ)—2683; Rev P. Holden (Methodist)—2683; Pastor G. Rollo (Seventh Day Adventist)—2683; Rabbi M. Kantor (Jewish)—3273.

The Students' Union is located on the second floor of Stage III of the University Union where the SU full-time President or Education Vice-President 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 co-op, a professional nursery/kindergarten (House at Pooh Corner), a typesetting service, electronic calculators (bulk purchasing), health insurance and AUS insurance, an information referral centre (the Infakt Bus) and publications such as Tharunka, Orientation Magazine, Concessions Book and counter-course handbooks. For information about these phone 2929.

Calendar of Dates

1976

Session 1	March 1 to May 9.
(14 weeks)	*May Recess:* May 10 to May 16
	May 17 to June 13
	Midyear Recess: June 14 to July 18
Session 2	July 19 to August 22
(14 weeks)	*August Recess:* August 23 to August 29
	August 30 to October 31
	Study Recess: November 1 to November 7

January

Thursday 1	New Year's Day—Public Holiday
Friday 9	Last day for application for review of results of *annual* examinations Last day for application for permission to re-enrol by students who infringed re-enrolment rules at *annual* examinations
Monday 12	Timetables for *deferred* examinations available
Friday 16	Last day for acceptance of applications by Admissions Office for transfer to another course within the University
Monday 26	Australia Day—Public Holiday
Tuesday 27	*Deferred* examinations begin

February

Saturday 7	*Deferred* examinations end
Monday 16	Enrolment period begins for new students and students repeating first year
Tuesday 17	Last day for appeal against exclusion by students who infringed re-enrolment rules at *annual* examinations
Friday 20	*Deferred* examination results available
Monday 23	Enrolment period begins for second and later year students
Tuesday 24	Last day for application for review of *deferred* examination results
Friday 27	Last day for application for permission to re-enrol by students who infringed re-enrolment rules at *deferred* examinations

March

Monday 1	**Session 1 commences**
Friday 12	Last day for acceptance of enrolments by new students (late fee payable)
Thursday 18	Last day for appeal against exclusion by students who infringed re-enrolment rules at *deferred* examinations
Thursday 25	Last day for acceptance of enrolments by students re-enrolling in second and later years (late fee payable)
Friday 26	Last day for students other than those attending the University for the first time to discontinue without failure subjects which extend over Session 1 only
Monday 29	Last day to enrol in additional subjects

April

Friday 16 to Monday 19	Easter
Friday 23	Last day for students attending the University for the first time to discontinue without failure subjects which extend over Session 1 only
Sunday 25	Anzac Day
Monday 26	Public Holiday

May

Tuesday 4	Publication of provisional timetable for June/July examinations
Monday 10	**May Recess begins**
Wednesday 12	Last day for acceptance of corrected enrolment details forms
Friday 14	Last day for students other than those attending the University for the first time to discontinue without failure subjects which extend over the whole academic year
Sunday 16	**May Recess ends**

Monday 17	Last day for students to advise of examination timetable clashes
June	
Tuesday 1	Publication of timetable for June/July examinations
Sunday 13	**Session 1 ends**
Monday 14	Queen's Birthday—Public Holiday **Midyear Recess begins**
Tuesday 15	Midyear examinations begin
Tuesday 29	Midyear examinations end
July	
Sunday 18	**Midyear Recess ends**
Monday 19	**Session 2 begins**
Friday 30	Foundation Day Last day for students attending the University for the first time to discontinue without failure subjects which extend over the whole academic year
August	
Friday 13	Last day for students other than those attending the University for the first time to discontinue without failure subjects which extend over Session 2 only
Monday 23	**August Recess begins** Holiday for non-academic staff
Sunday 29	**August Recess ends**
Tuesday 31	Last day for acceptance of applications for re-admission in 1977 after exclusion under the re-enrolment rules
September	
Friday 10	Last day for students attending the University for the first time to discontinue without failure subjects which extend over Session 2 only
Sunday 12	Last day for applications from students graduating in 1977 for admission to University degrees and diplomas
Tuesday 14	Last day for return of corrected enrolment details forms
Tuesday 21	Publication of provisional timetable for annual examinations
October	
Friday 1	Last day to apply to MUAC for transfer to another university in Sydney metropolitan area and Wollongong Last day for students to advise of examination timetable clashes
Monday 4	Eight Hour Day—Public Holiday
Tuesday 19	Publication of timetable for annual examinations
November	
Monday 1	**Study Recess begins**
Sunday 7	**Session 2 ends**
Monday 8	Annual examinations begin
Tuesday 30	Annual examinations end
December	
Saturday 25	Christmas Day—Public Holiday
Monday 27	Boxing Day—Public Holiday

1977

Session 1	March 7 to May 14 *May Recess:* May 16 to May 21 May 23 to June 18 *Midyear Recess:* June 20 to July 23
Session 2	July 25 to August 27 *August Recess:* August 29 to September 3 September 5 to November 5 *Study Recess:* November 7 to November 12
January	
Monday 3	Public Holiday
Friday 7	Last date for application for review of results of *annual* examinations
Monday 10	Publication of timetable for *deferred* examinations
Friday 14	Last day for acceptance of applications by Admissions Office for transfer to another course within the University
Tuesday 25	*Deferred* examinations begin
Monday 31	Australia Day—Public Holiday
February	
Saturday 5	*Deferred* examinations end
Monday 14	Enrolment period begins for new students and students repeating first year
Friday 18	Results of *deferred* examinations available
Monday 21	Enrolment period begins for second and later year students
Tuesday 22	Last day for applications for review of *deferred* examination results

The Academic Year

The academic year is divided into two sessions, each containing 14 weeks for teaching. There is a recess of five weeks between the two sessions as well as short recesses of one week within each of the sessions.

Session 1 commences on the first Monday of March.

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 1975 the University had 18,128 students and 3,984 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.

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 42 members representative of the professions, commerce and industry, the legislature, employee organizations, rural, pastoral and agricultural interests, and the academic staff of the University, its graduates and students.

The Council meets six times per year and its members also serve on special committees dealing with such matters as finance, buildings and equipment, personnel matters, student affairs and public relations.

The Chairman of the Council is the Chancellor, Sir Robert Webster, and the Deputy Chancellor is the Hon. Sir Kevin Ellis.

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

The Dean, who is also a professor, is the executive head of the Faculty. Members of each Faculty 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. In addition, the Board of Studies in General Education fulfils a function similar to that of the faculties. The Board of Studies in Science is responsible for the academic administration of the Science 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 professorial Head of the School in which you will be studying will be 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, 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 J. B. Thornton, Professor R. E. Vowels and Professor A. H. Willis; 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 C. G. Plowman, the Bursar, Mr T. J. 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 concerned with the maintenance of buildings and grounds and equipment, and includes the University Architect's office.

Student Representation on Council and Faculties

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 one of their number to a Faculty for each 500 registered students, with a minimum of three students per Faculty. Elections take place towards the end of the academic year for a one-year term of office.

Open Faculty Meetings

If you wish you may attend a Faculty meeting. You should seek advice at the office of the Faculty whose meeting you wish to attend, as different faculties have their own rules for the conduct of open meetings.

Identification of Subjects by Numbers

For information concerning the identifying number of each subject taught in this faculty, turn to the first page of the main section below entitled Subject Descriptions and Textbooks.

See the Calendar for the full list of identifying numbers and subjects taught in the University.

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 publishes its own Handbook which is available free of charge. All enquiries about General Studies should be made to the General Studies Office, Room G54, Morven Brown Building (663 0351 Extn. 3478).

Student Services and Activities

The University Library

The University Library is on the upper campus adjacent to the Chancellery, the Sciences Building, the Goodsell and the Morven Brown Buildings. The Biomedical Library is in the western end of the Sciences Building with a branch at Prince Henry Hospital, telephone 661 0111. The University Library buildings house the Law Library, the Physical Sciences Library, the Social Sciences and Humanities Library and the Undergraduate Library.

There are services at other centres:

Broken Hill Division: W. S. and L. B. Robinson University College Buildings, Broken Hill. Phone: 6022/3/4.

Water Reference Library: Manly Vale. Phone: 948 0261.

Each library provides a reference and lending service for staff and students, and is open in both Sessions 1 and 2 during day and evening periods, except the Water Reference Library which is only open during the day.

Staff and students must use a machine-readable identification card to borrow from the main University Library. Personal identification is required in the other libraries listed. For students a current Union card is acceptable. Staff must apply to the Library for a library card.

New students can collect temporary borrowing cards at the Library in Orientation Week. It is recommended that students attend the *Introduction to the Library* held during Orientation Week and the first week of Session 1.

Specific library problems should be referred to the Reader Assistance Unit located in the foyer of the Library. Copies of the *Library Guide* are available on request.

Accommodation

There are seven **residential colleges** on campus which offer accommodation to male and female students. The philosophy of the management, the residence fees and facilities vary from college to college. In addition to the basic fees charged most colleges make additional minor charges such as a registration fee and a power charge. It is anticipated that the fees in most colleges will be increased for 1976. Assistance is also provided in finding **off-campus accommodation.**

The Kensington Colleges The Kensington Colleges comprise Basser College, Goldstein College, and Philip Baxter College. They house 450 men and women students, as well as 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 over 120 students from Australia and 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. Apply in writing to the Master, Shalom College, The University of New South Wales, PO Box 1, Kensington, NSW 2033.

Warrane College An affiliated Roman Catholic residential college, Warrane provides accommodation for 200 men students, both graduate and undergraduate. Non-resident membership is available to male students who wish to participate in College activities and make use of its facilities. Fees are payable on a session basis. Apply in writing to the Master, Warrane College, PO Box 123, Kensington, NSW 2033.

Off-campus Housing The Student Amenities and Recreation Unit maintains an up-to-date record of different types of off-campus housing including hostels, full board, bed and breakfast, flats and houses for rent. For information and assistance apply to the Housing Officer, Hut B, at the foot of Basser Steps (extension 3260).

Student Employment

The Student Employment Unit 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 campus interview program for final year students.

Careers advice and assistance is also available to undergraduates. Assistance is offered in finding vacation employment which gives either course-related experience or industrial training experience, where this is a course requirement. Information and advice regarding cadetships, undergraduate and graduate scholarships is also available.

The service is located in the Chancellery on the ground floor.

Phone extension 3259 for employment and careers advice, or extension 2086 for cadetships and industrial training information.

Student Health

The Student Health Unit, staffed by qualified medical personnel, offers free medical and first-aid services to male and female students. The service is not intended to replace private or community health services and thus if chronic or continuing conditions are revealed or suspected you will be advised and referred to your own doctor or an appropriate hospital. The health service is not responsible for fees incurred in these instances. Confidential appointments can be made at Hut E at the foot of Basser Steps between 9 am and 5 pm Monday to Friday. Phone extension 2679 or 3275.

Student Counselling and Research

The Student Counselling and Research Unit provides individual and group counselling for all students—prospective, undergraduate and graduate. If you have any personal needs, worries or confusion use this free, informal, personal service to help you sort out the basic issues. If the counsellor can't help you himself he usually knows someone who can.

Counselling appointments are available during sessions and recesses between 9 am and 7 pm. Phone 663 0351 extensions 2696 and 2600 to 2605, or call during Unit office hours, 8.30 am to 5.30 pm. 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.

Student Amenities and Recreation

This Unit, working in close liaison with the Sports Association, assists various recognized clubs by arranging and providing facilities and by handling on their behalf all inquiries and applications for membership.

It also provides a recreational program for students and staff at the Physical Education and Recreation Centre; liaises with the Public Transport Commission of New South Wales on matters concerning student travel concessions; and assists students in finding suitable accommodation off the campus.

Concessional application forms for all types of travel may be obtained at the Student Amenities and Recreation Unit or at the Information Desk in the Chancellery.

The Student Amenities and Recreation Unit is located in Hut B at the foot of Basser Steps. The various services may be contacted by phone on the following extensions: Sports Association, 2235; Physical Education and Recreation Centre, 3271; Travel, 2617; Accommodation, 3260.

Physical Education and Recreation Centre

The Physical Education and Recreation Centre consists of eight squash courts and a main building. The latter has a large gymnasium and ancillary practice rooms for fencing, table tennis, judo, weight-lifting and a physical fitness testing room. The Supervisor of Physical Recreation is responsible for the Centre and provides a recreational program for both students and staff. If you would like to take part in any of the programs contact the Supervisor on extension 3271.

The University Union

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

The Union is housed in three buildings near the entrance to the Kensington Campus from Anzac Parade. These are the Roundhouse, the Blockhouse and the Squarehouse. Membership of the Union is compulsory at $45 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.

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 two years at the University are eligible for election.

Membership is compulsory at $10 per annum.

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.

The Students' Union is affiliated with the Australian Union of Students (AUS) which represents students on the national level.

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

Chaplaincy Centre

This service is provided for the benefit of students and staff by five Christian Churches and by the Jewish congregation. 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.

Student Clubs and Societies

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; Ngunnagan Club; Kite Club and the Jazz Society.

The Sports Association The Sports Association caters for a variety of competitive sports for both men and women. Membership of the Association is compulsory for all registered students and the annual subscription is $6.

Details of sporting facilities are available in the Orientation Magazine, available at the Student Amenities and Recreation Unit (Hut B at the foot of Basser Steps).

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

Other Services and Activities

University Co-operative Bookshop Limited Membership is open to all students, on payment of a fee of $5, 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 notice boards for details.

Australian Armed Forces Enquiries should be directed to:

Royal Australian Navy: Royal Australian Naval Liaison Officer, Professor J. S. Ratcliffe, Commander, R.A.N.R., at the School of Chemical Engineering. Phone extension 2406.

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 R.A.A.F. Undergraduate Scheme should contact The Recruiting Officer, Defence Forces Recruiting Centre, 320 Castlereagh Street, Sydney.

Financial Assistance to Students

Tertiary Education Assistance Scheme

Under this scheme, which is financed by the Australian Government, assistance is available as follows:

- for full-time study in approved courses
- subject to a means test
- on a non-competitive basis
- to students who are not bonded
- to students who are permanent residents of Australia.

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

- Undergraduate and graduate degree courses
- Graduate diplomas
- Approved combined Bachelor degree courses
- Master's qualifying courses where the course is the equivalent of an honours year and the student has not attempted an honours year.

Benefits

Means-tested Living Allowance The maximum rates of living allowances are $1,000 per annum for students living at home and $1,600 per annum for students living away from home. The maximum rates of living allowance will be paid where the adjusted family income is equal to *or* less than $7,600 per annum. The adjusted family income is assessed by subtracting from the gross income of both parents their business expenses and an amount of $450 for each dependent child other than the student.

When the adjusted family income exceeds $7,600 p.a. the amount of living allowance will be reduced by $2 for every $10 of income until the family income exceeds $15,200 per annum. After this level, the living allowance will be reduced by $3 for every $10 of income.

A concession may be made where there are other children in the family undertaking tertiary education with scholarship assistance from schemes other than the Tertiary Education Assistance Scheme of less than $600 pa.

Students qualifying for living allowance will also receive the following allowances where appropriate:

Incidentals Allowance The Incidentals Allowance of $100 is designed to help the student meet the cost of those fees which have not been abolished—the Students' Union, University Union and Sports Association fees, and other expenses associated with their studies.

Travel Allowance Students whose home is in the country may be reimbursed the cost of three return trips per year, during vacation time.

Dependants' Allowance This is made up of allowances of $15 per week for a dependent spouse and $7 per week for each child.

How to Apply If you were a 1975 Higher School Certificate candidate or a tertiary student receiving an allowance, you were sent forms last October. Other students may obtain forms from the Admissions Section *or* the Student Employment and Scholarships Unit, *or* from the Regional Director, Department of Education, Central Square, 323 Castlereagh Street, Sydney, N.S.W. 2000 (Telephone 218 8800). The administrative closing date for 1976 applications was 31 October 1975.

Scholarships, Cadetships, Prizes

1 *Undergraduate Scholarships* In addition to finance provided under the Australian 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 School office.

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

2 *Graduate Awards* An honours 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 University Calendar.

Other Financial Assistance

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

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

2 *Short Term Cash Loans* Donations from 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 Australian 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.

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.

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

Inquiries about all forms of financial assistance should be made at the office of the Deputy Registrar (Student Services), Room 148A, in the Chancellery.

Financial Assistance to Aboriginal Students

Financial assistance is available from a number of sources to help Aboriginal students. Apart from the Australian Government's Tertiary Education Assistance Scheme there is a Commonwealth Aboriginal Study Grant Scheme. Furthermore, the University may assist Aboriginal students with some essential living expenses in exceptional circumstances.

All inquiries relating to this scheme should be made at the office of the Deputy Registrar (Student Services), Room 148A, 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 efficiently and equitably 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 (e.g. fines or exclusion from examinations) for failure to observe these procedures and therefore they should be read with care.

The information is arranged as answers to questions most asked by students. The first group of questions concerns admission and enrolment, the second fees and other money matters, the third examinations, and the remainder more general matters such as student conduct on campus.

Admission and Enrolment

How do I qualify for admission? In order to enter an undergraduate course you must qualify for matriculation to the University; satisfy requirements for admission to the course of subjects chosen; and be selected for admission to the faculty or course you wish to enter. Full details of matriculation and admission requirements are contained in a pamphlet obtainable at the Admissions Office and in the Calendar.

All students, except those enrolling in graduate research degrees (see below), must lodge an authorized enrolment form with the Cashier on the day the enrolling officer signs the form.

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

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 below). Payment may be made through the mail in which case it is important that the student registration number be given accurately.

New Undergraduate Enrolments Persons who are applying for entry in 1976 must lodge an application for selection with the Metropolitan Universities Admissions Centre, PO Box 7049, GPO, Sydney 2001, by 1 October 1975.

Those who are selected will be required to complete enrolment at a specified appointment time before the start of Session 1. Compulsory fees must be paid on the day of the appointment. In special circumstances, however, and provided class places are still available, students may be allowed to complete enrolment after the prescribed week, subject to the payment of a penalty (see below).

Application forms and details of the application procedures may be obtained from the Admissions Office.

First Year Repeat Students First year students who failed more than half the programme at the 1975 Annual Examinations and who were not granted any deferred examinations should NOT follow the above procedure. They are required to *show cause* why they should be allowed to continue in the course, and should await instructions in writing from the Registrar as to the procedure.

Later Year Enrolments Students should enrol through the appropriate School in accordance with the procedures set out in the current year's booklet, *Enrolment Procedures,* available from the Admissions Office and from School offices.

New Research Students Students enrolling for the first time in graduate research degrees will receive an enrolment form by post. They have two weeks from the date of offer of registration in which to lodge the enrolment form with the Cashier and pay the appropriate fees. Completion of enrolment after this time will incur a penalty (see below).

Re-enrolling Research Students Students re-enrolling in research degrees should lodge the enrolment form with the Cashier as soon as possible but no later than the end of the second week of Session 1. Completion of enrolment after this date will incur a penalty (see below).

Submission of Graduate Thesis or Project Report at Commencement of Session 1 A candidate who has completed all the work for a graduate degree except for the submission of a thesis or project report is required to re-enrol and pay fees as outlined above *unless* the thesis or project report is submitted by the end of the second week of Session 1 in which case the candidate is not required to re-enrol. Those required to re-enrol may claim a refund of fees if able to withdraw (see below).

Miscellaneous Subject Enrolments Students may be permitted to enrol for miscellaneous subjects (ie as students not proceeding to a degree or diploma) provided the Head of the School offering the subject considers it will be of benefit to the student and there is accommodation available. Only in exceptional cases will subjects taken in this way count towards a degree or diploma. A student who is under exclusion may not be enrolled in miscellaneous subjects which may be counted towards any course from which he has been excluded.

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 (12 March 1976) except with the express approval of the Deputy Registrar (Student Services) and the Head of the School 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 (26 March 1976) without the express approval of the Deputy Registrar (Student Services). No enrolments for courses occupying Session 2 only will be accepted after the end of the second week of Session 2 (30 July 1976) without express approval of the Deputy Registrar (Student Services).

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 University Calendar.

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 in writing to the Deputy Registrar (Student Services) for an extension of time which may be granted in extenuating circumstances.

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 (23 April 1976). 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 (27 August 1976).

In very 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 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 16 January. 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. You should also inform the enrolling officer of the school in which you are enrolled of your intention to transfer.

Can I change my course program? If you wish to seek approval to substitute one subject for another, 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 Head of the School responsible for the course on forms available from the School office. The Registrar will inform you of the decision. Application to enrol in additional subjects must be submitted by the end of the fourth week of Session 1.

It is emphasized that failure to sit for examinations in any subject in which you are enrolled will be regarded as failure to satisfy the examiners in that subject unless written approval to withdraw without failure has been obtained from the Registrar.

Withdrawal from subjects Students are permitted to withdraw from subjects without being regarded as having failed, provided they apply by the dates indicated.

First Year Students

1. one-session subjects: the end of the eighth week of session;

2. double-session subjects: the end of the second week of Session 2.

For the purpose of this rule a first-year student is defined as one who is attending the University for the first time either on a full- or part-time basis and is enrolled in the first year or first stage of a course.

Other Students

1. one-session subjects: the end of the fourth week of session;

2. double-session subjects: the end of the May Recess.

How do I enrol after an absence of twelve months or more? If you have had a leave of absence for twelve months 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 in December of the preceding year or before October in the year preceding the one in which you wish to resume your course.

If you have not obtained leave of absence from your course and have not been enrolled in the course over the past twelve months or more, then you should apply for admission to the course through the Metropolitan Universities Admission 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 for the first time in any undergraduate course in the University shall be required to

show cause why he/she should be allowed to continue the course if that student 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.* Failure in a deferred examination as well as in the initial examination counts for the purposes of this rule as one failure.

General Rule

3. The Re-enrolment Committee may, on the recommendation of the relevant faculty or board of studies, review the academic progress of any student. If that student's academic record seems to demonstrate, in the opinion of the Committee, the student's lack of fitness to pursue a subject or subjects and/or a course or courses, the Committee may require that student to show cause why he/she should be allowed to re-enrol in such subject(s) and/or course(s).

The Session-unit System

4. A A student who infringes the provisions 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.

B 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. A 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.

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

'Showing Cause'

6. A 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.

B 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. A 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, or 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.

B 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.

C 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. A 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 account 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.

* For details of Schedule A see University Calendar.

* It is proposed that under this arrangement, the membership of the Appeal Committee will be Pro-Vice-Chancellor J. B. Thornton (Chairman), Professor D. M. McCallum, Chairman of the Professorial Board, and a member of Council in the category of members elected by the graduates of the University, nominated by the Vice-Chancellor.

B 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.

C A student excluded from a course or courses under the provisions of A or B may not enrol as a miscellaneous student in subjects which may be counted towards any such course.

Re-admission after Exclusion

9. A An excluded student may apply to the Re-enrolment Committee for re-admission after two academic years.

B An application for re-admission after exclusion should be made on the form available from the Examinations and Student Records Section and should be lodged with the Registrar not later than 31 August in the year prior to that for which re-admission is sought. A late application may be accepted at the discretion of the University.

C 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 appropriate study in the subject(s) (or the equivalent) on account of which the applicant was excluded.

Restrictions and Definitions

10. A These rules do not apply to students enrolled in programs leading to a higher degree or graduate diploma.

B 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? Applications for admission to a degree or diploma of the University must be made on the appropriate form by 12 September, in a student's final year. Forms are mailed to all final year students. Don't forget to inform the University if you subsequently change your address so that correspondence related to the ceremony will reach you without delay. Applicants should ensure that they have completed all requirements for the degree or diploma, including industrial training where necessary. Any variation such as cancelling of application in order to proceed to an honours degree or submission of an application following discontinuation of honours program, must be submitted in writing to the Registrar no later than 30 January.

Fees*

Do I have to pay fees for tuition? No. There are no fees for tuition but other fees and charges are payable.

What other fees and charges are payable? These 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 procedures 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 their personal use during attendance in certain subjects. Accommodation 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, but the full University Union entrance fee, if applicable.

University Union entrance fee—$20 payable on first enrolment

Students Activities Fees:

University Union—$45 annual subscription

Sports Association—$6 annual subscription

Students' Union:

Students enrolling in full-time courses—$10 annual subscription

Students enrolling in part-time courses—$8 annual subscription

Miscellaneous—$25 annual fee.

(The miscellaneous fee is used to finance expenses generally of a capital nature relating to student activities. Funds are allocated to the various student bodies for projects recommended by the Student Affairs Committee and approved by the University Council.)

Depending on the subject being taken, students may also be required to pay:

Pathology Instrument Kit—$10
(Refundable on return in satisfactory condition)

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 Students Activities Fees and the University Union entrance fee.

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

3. University Union fees and subscriptions may be waived by the Deputy Registrar (Student Services) for students enrolled in graduate courses in which the academic requirements require either no or minimal attendance on the Kensington campus.

4. Students who while enrolled at another university in Australia 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.

5. 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.

6. 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.

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

How much will textbooks and special equipment (if any) cost? You must allow quite a substantial sum for textbooks. This can vary from $200 to $600 depending on the course taken. These figures are based on the cost of new books. The Students' Union operates a second-hand 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.

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 1976 when fees are paid late:

Failure to lodge enrolment form according to enrolment procedure	$20
Payment of fees after end of second week of session	$20
Payment of fees after end of fourth week of session	$40

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

Yes. The following rules apply:

1. If you withdraw from a course 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.

Examinations

When are examinations held? Most annual examinations are held in November-December but examinations in many subjects are also 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 central notice boards in the Biological Sciences Building, the Chancellery, Central Lecture Block, Dalton Building (Chemistry), Main Building (Mining and Physics), and in the Western Grounds Area on 4 May and 21 September. You must advise the Examinations Unit (Chancellery) of a clash in examinations by 17 May and 1 October. Final timetables are displayed and individual copies are available for students on 1 June and 19 October.

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

In the assessment of your progress in University courses, consideration is 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. 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 Terminating Pass may be granted where the mark for the subject is below the required standard. A terminating pass will not permit a student to progress further in the subject or to enrol in any other subject for which a pass in the subject is a co-requisite or prerequisite. A student given a terminating pass may attempt a deferred examination, if available, to improve his performance but should he fail in such attempt, the terminating pass shall stand.

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 Information Desk, Chancellery, also by 30 November). Results are also posted on School notice boards and in the foyer of the Sir John Clancy Auditorium. No examination results are given by telephone.

Can examination 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 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 by the following dates:

Annual examinations held in November/December 1976 —Friday 7 January 1977.

Deferred examinations held in January/February 1977 —Tuesday 22 February 1977.

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,* and may be required to submit to medical examination.

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.

All medical certificates should be as specific as possible concerning the severity and duration of the complaint and its effect on the student's ability to take the examinations.

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.

A student suffering from a physical disability which puts him at a disadvantage in written examinations should apply to the Registrar in writing for special provision when examinations are taken. The student should support his request with medical evidence.

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 under special circumstances.

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 ten 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. No candidate shall be admitted to an examination after thirty minutes from the time of commencement of the examination.

5. No candidate shall be permitted to leave the examination room before the expiry of thirty minutes from the time the examination commences.

6. No candidate shall be re-admitted to the examination room after he has left it unless during the full period of his absence he has been under approved supervision.

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

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

9. All answers must be in English unless otherwise directed. Foreign students who have the written approval of the Officer-in-Charge of Examinations may use standard translation dictionaries.

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.

Should I list my sources? Students are expected to acknowledge the sources of ideas and expressions that they use in essays. 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.

Under what circumstances are deferred examinations granted? Deferred examinations may be granted in the following cases:

1. When a student through illness or some other acceptable circumstance has been prevented from taking the annual examination or has been placed at a serious disadvantage during the annual examinations.

2. To help resolve a doubt as to whether a student has reached the required standard in a subject.

3. To allow a student by further study to reach the required standard in a subject.

4. Where a student's progression or graduation is inhibited by his failure in one subject only, a deferred examination may be granted notwithstanding his failure otherwise to qualify for this concession.

In the Faculties of Arts, Commerce and Law special circumstances apply in the granting of deferred examinations. Details in each circumstance are given in the section *Faculty Information* in the respective handbooks for these faculties, or in the Calendar.

Deferred examinations must be taken at the centre at which the student is enrolled, unless he has been sent on compulsory industrial training to a remote country centre or interstate. In this case the student must advise the Registrar, on a form available from his school or the Information Desk, the Chancellery, of relevant particulars, before leaving for his destination, in anticipation that deferred examination papers may have to be forwarded to him. Normally, the student will be directed to the nearest university for the conduct of the deferred examination.

Can I buy copies of previous examination papers? Yes—for 5c each from the Union Shop in the University Union.

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.

However, 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 of not more than one month or, on the recommendation of the Dean of the appropriate Faculty, for a longer period.

Applications for exemption from lectures (leave of absence) should be addressed to the Registrar and, where applicable, should be accompanied by a medical certificate. If examinations have been missed, state this in your application.

If you fail a subject at the annual examinations in any year and re-enrol in the same course in the following year, you must include in your program of studies for that year the subject in which you failed. This requirement will not be applicable if the subject is not offered the following year; 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.

If you attend less than eighty per cent of your possible classes, you may be refused permission to sit for the examination in that subject.

Why is my University Union card important? All students are issued with a University Union membership card. Your card must be carried during attendance 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 quoted in all correspondence.

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

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

New students will be issued with University Union 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 Information Counters on the Ground Floor of the Chancellery Building.

These will be accepted up to 30 November, except for final year students who may advise changes up to four weeks before their 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 impracticable to gain the student's prior permission. This happens rarely. This policy is considered so important that it often involves officers of the University in very difficult situations, for example, when they must refuse to reveal the address of a student to parents or other relatives.

In spite of the policy, 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 26 April and 30 August. 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 fourteen 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? Because of the limited amount of parking space available, only the following categories of students may apply for a permit: motor cycle owners (annual fee $3.90; masters and doctoral candidates (ballotted issue, annual fee $7.80); graduate, and senior undergraduate students who have completed two or three years of a full-time or part-time course (annual fee $3.90—only a limited number of permits available for students who have completed two years). A permit will allow access to the campus between 5 pm and 11 pm on weekdays and during library hours on Saturdays, Sundays and public holidays. Enquiries should be made to the Property Section, Room 240, the Chancellery, or phone 663 0351, extension 2920. It should be noted that increasing demand for parking space may require the imposition of further restrictions and that rates may change for 1976.

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 from the Admissions Office, the Student Counselling Unit or the Registrar.

Admissions Office

The Admissions Office provides students with information concerning courses, admission requirements and enrolment procedure.

It will receive applications from students who wish to defer or resume courses of study, to transfer from one course to another, or seek any concession in relation to a course in which they are enrolled.

These applications should, wherever possible, be lodged before the beginning of the academic year in which the concession is to apply.

Students in doubt as to whether an application is necessary to cover their own particular situation should enquire at the Admissions Office.

The Admissions Office is located in the Chancellery on the upper campus. Office hours are from 9 am to 1 pm and 2 pm to 5 pm. Monday to Friday. An evening service is provided during the enrolment period.

Notices

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

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.

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 in the fields of Applied Geography, Applied Geology, Chemical Engineering, Chemical Technology, Food Technology, Metallurgy, Mining Engineering, Textile Technology and Wool and Pastoral Sciences are well established. 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

Staff

Comprises Schools of Applied Geology, Chemical Engineering, Chemical Technology, Geography, Metallurgy, Wool and Pastoral Sciences, Textile Technology, and Mining Engineering.

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Chairman
Professor R. T. Fowler
Senior Administrative Officer
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School of Applied Geology

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Professor of Geology
Vacant

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Professor of Mining Engineering and Head of School
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Professor
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Mining Engineering

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Nicholas Buchsbaum, BSc *Haifa*, MSc *N.S.W.*
Michael David Young, BSc PhD *N.S.W.* ATI
Ota Zubzanda, DipIng *T.U.Bratislava*

School of Wool and Pastoral Sciences

Professor of Wool Technology and Head of School
Patrick Reginald McMahon, MAgrSc *N.Z.*, PhD *Leeds*, MAIAS, ARIC

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Ronald Edward Sallaway

Professional Officer
Edgar Devaud, IngAgr *Concepción*

Professional Officers (Faculty)
Endel Nomm, BA *Macq.*
Vivian Noel Edward Robinson, BSc PhD *W.Aust*
Dante Somin Santea, Dipling *T.I.Iassy*

Faculty Information

Faculty of Applied Science Enrolment Procedures

Preliminary Enrolment

Courses in 301 Applied Geography, 300 Applied Geology, 303 Ceramics, 302 Ceramic Engineering, 304 Chemical Engineering, 306 Food Technology, 310 Industrial Chemistry, 312 Metallurgy, 314 Mining Engineering, 317 Textile Technology, 318 Metallurgical Process Engineering, 322 Wool and Pastoral Sciences, 321 Wool and Pastoral Sciences (Education Option).

Before proceeding on vacation students are required to attend the office of the respective School to complete the necessary preliminary enrolment procedures.

School of Geography

Re-enrolment forms will be obtainable from the School Office, Room 1009, Applied Science Building, from early October. These are to be collected and returned completed no later than 23 January. Any students requiring advice on their 1976 program can make an appointment to discuss it by telephoning 662 2084, or calling at the School Office.

Enrolment Timetable

Students in any of the above courses are required to attend Unisearch House in accordance with the following timetable.

1. Full-time Courses

Year 2, and Year 1 repeats	Thursday 26 February 9.30 am to 12.30 pm (Courses 300-310) 2.00 pm to 4.30 pm (Courses 312-322)
Year 3	Tuesday 24 February 9.30 am to 12.30 pm (Courses 300-310) 2.00 pm to 4.30 pm (Courses 312-322)
Year 4	Monday 23 February 9.30 am to 12.30 pm (Courses 300-310) 2.00 pm to 4.30 pm (Courses 312-322)

2. Part-time Courses

Stage 1 repeats and Stage 2, 3, 4, 5, 6 and later stage students.	Wednesday 25 February 2.00 pm to 4.30 pm (All courses) and 6.00 pm to 8.00 pm (All courses)

3. New Students with Advanced Standing

Friday 27 February
9.30 am to 12.30 pm
(All courses)

General Studies

Students enrolling in general studies electives after completing enrolment in their own Faculty and BEFORE GOING TO THE CASHIER, should proceed to the General Studies enrolment centre in Unisearch House where they will obtain places in electives, complete class admission cards and finalize enrolment forms.

Enrolment Centre

Unisearch House
221 Anzac Parade
(across from Main Campus)

Late Enrolments

Students are strongly advised to attend for enrolment *during Enrolment Week* as those who fail to do so not only miss initial classes but disrupt lecture, tutorial and practical work programs and cause considerable inconvenience to lecturers and the punctual students.

There are two late enrolment sessions:

First Late Enrolment Period
Wednesday 3 March

Second Late Enrolment Period
Wednesday 10 March

The times and locations for late enrolment are:
Administrative Office
of appropriate School
5.00 pm to 7.00 pm

Conditions for the Award of the Degrees of Bachelor of Science (Technology) and Bachelor of Science (Engineering)

The courses leading to the award of the degrees of Bachelor of Science (Technology) and Bachelor of Science (Engineering) are normally programmed over six years of part-time study in the University whilst the student is employed in industry. The regulations governing the award of this degree are as follows:

1. A candidate for the degrees of BSc(Tech) or BSc(Eng) shall:
A comply with the requirements for admission;
B follow the prescribed course of study in the appropriate school and pass the necessary examinations;
C complete an approved program of industrial training over such period as is prescribed concurrently with attendance in the course. In general, this training must be completed before 31 January in the year in which the degree is to be recorded.

2. During each year a student shall perform laboratory, drawing office and field work, attend demonstrations and excursions to such an extent and in such a manner as is prescribed from time to time by the Professorial Board on the recommendation of the Faculty, and, in addition, undertake industrial training as approved by the Head of the School.

3. A student may be granted advanced standing by the Professorial Board on the recommendation of the appropriate Faculty but in each case a student must follow an approved course for at least three years with such period of approved industrial training as is prescribed before being eligible for admission to the degree.

4. 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".

5. Students shall be required to conform with the general rules relating to progression in University courses.

Conditions for the Award of the Degree of Bachelor of Engineering

1. A candidate for the degree of Bachelor of Engineering shall:
A comply with the requirements for admission;
B follow the prescribed course of study in the appropriate School, and satisfy the examiners in the necessary subjects;
C complete an approved program of industrial training for such periods as are prescribed. In general, this training must be completed before 31 January in the year in which the degree is to be awarded.

2. During each year a student shall perform laboratory, drawing office and field work, attend demonstrations and excursions to such an extent and in such a manner as is prescribed from time to time by the Professorial Board on the recommendation of the Faculty.

3. A student shall be required to complete the first year of the course in not more than two years. Re-enrolment thereafter will be governed by the general regulations of the Professorial Board.

4. A student may be granted advanced standing by the Professorial Board on the recommendation of the appropriate Faculty, but in each case must complete an adequate period of approved industrial training before being eligible for the degree except for students in the School of Electrical Engineering, where such training is recommended but not required. In addition to the above requirements a student coming from another institution must follow an approved course of study in this University for at least two years.

5. 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

General Rules for Progression

1. Course programs will be stated and timetabled by year and by stage.

2. Students must satisfy the rules governing re-enrolment, particularly those requiring that all first-year subjects must be completed by the end of two years' full-time or four years' part-time study.

3. Before being permitted to enrol in any subject, students must satisfy the relevant prerequisite subject requirements. Normally this will necessitate students attempting to satisfy requirements of subjects of a particular year or stage before proceeding to subjects in the next part of the course. Details of prerequisite subjects, co-requisite subjects and any special rules governing progression in particular courses should be obtained from the relevant school.

4. Only in exceptional circumstances will students be permitted to enrol in subjects extending over more than two years of a full-time course, or two stages of a part-time course, or for more than 28 hours of course work per week if full-time or 14 hours per week if part-time. Students repeating subjects are required to select a program with the approval of the Head of School which limits their hours of course work to 24 hours per week if full-time

and 12 hours per week if part-time. Extension of these hours will need the special permission of the Head of School.

5. Students shall enrol in courses as full-time students or in those Schools offering part-time courses as part-time students. Transference between full-time and part-time courses will be permitted once only. Students who transfer will be expected to remain in their new course until the completion of all academic and practical requirements of that course.

6. Notwithstanding the above, students can enrol in any non-standard program only with permission of the Head of School. A non-standard program is one that involves enrolment in subjects from more than one year, or two stages, or which comprises subjects which do not normally constitute a particular year's course work.

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, 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 degree of Bachelor of Science (Technology) or Bachelor of Science (Engineering).

Full-time Courses

Full-time courses of four years' duration leading to 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 degree of Bachelor of Engineering are offered in Chemical 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 is maintained on the practical aspects of the professions. This is achieved in most of the courses of the Faculty by expecting students to complete an approved industrial training program prior to graduation. This is normally carried out during the Summer Recess. In the case of Wool and Pastoral Sciences, students are required to complete twenty-four weeks' approved practical work. In Mining Engineering students will undertake a program of practical training of at least 100 days.

Part-time Courses

Six-year, part-time courses leading to the degree of Bachelor of Science (Technology) are offered in Food Technology by the School of Chemical Engineering; 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 degree of Bachelor of Science (Engineering) is available at Broken Hill.

Students who qualify for the BSc(Tech) degree in the Faculty of Applied Science and who wish to proceed to 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 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) courses, but one of the conditions for the award of the BSc(Tech) and BSc(Eng) degrees is that at least three years of approved industrial experience be gained before graduation. This requirement will apply to students transferring from full-time courses.

BSc(Tech) and BSc(Eng) Courses With Partial Full-time Attendance

BSc(Tech) and BSc(Eng) 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

The development of natural resources and national development necessitates a type of training for geologists which embraces basic geological instruction and various features of its application in practice. The structure and syllabus of the course in Applied Geology are designed to enable graduates to enter immediately into various aspects of applied geology and to play an effective part in associated engineering and technological practice.

In the early part of the course students receive instruction in the allied fundamental sciences, as well as in introductory geology. Later, geological instruction is developed and emphasis is placed progressively on engineering applications and on economic aspects of geology.

The applied nature of the course is indicated by the inclusion of subjects such as Mining and Mineral Process Engineering. Courses in exploration geophysics, mineral exploration, petroleum geology and engineering geology are offered in the later stages of the program.

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. The second session of the fourth year is devoted essentially to work on a project.

A three-year course (full-time) is available to students in the Faculty of Science, and some provision is made for part-time study in geology within that Faculty. Selected students in the Faculty of Science may read for an Honours Degree in Geology. Master of Applied Science courses in Hydrogeology-Engineering Geology, in 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.

300
Applied Geology—Full-time Course

Bachelor of Science
BSc

Year 1

		Hours per week
25.011	Geology I*	6
1.001	Physics I *or*	
1.011	Higher Physics I	6
2.001	Chemistry I	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I	6

* Three field tutorials, involving up to five days in all are an essential part of the course. Attendance is compulsory.

Year 2

		Hpw S1	Hpw S2
25.012	Geology 2A*†	6	6
25.022	Geology 2B*†	3	3
2.002A	Physical Chemistry		
2.002C	Analytical/Inorganic Chemistry	7	5
	General Studies Elective	1½	1½

* Field work of up to six days in each case is a compulsory part of the course.
† Prerequisites: 25.011 Geology I and 2.001 Chemistry I.

Students are required to take one of the following groups of subjects:

		Hpw S1	Hpw S2
Group A			
1.112A	Electromagnetism	0	6
1.112C	Thermodynamics and Mechanics *and*	6	0
10.211A	Mathematical Methods	2	2
or			
Group B			
1.212T	Physics IIT (Units B&C)	3	3
10.111A	Linear Algebra *and*	2	2
10.111B	Analysis	2	2
or			
Group C			
1.212T	Physics IIT (Units B&C)	3	3
5.010	Engineering A *and*	6	
5.020	Engineering B	0	6
or			
Group D			
1.212T	Physics IIT	3	3
17.011	Biology of Mankind *and*	6	0
17.021	Comparative Functional Biology	0	6

Year 3

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

† Prerequisites: 25.012, 25.022.
* A geological survey camp of 10 days' duration is a compulsory part of this course.
§ Field tutorials constitute an essential part of this course.
‡ Co-requisites: 25.013, 25.023.

Year 4

		Hpw S1	Hpw S2
7.023	Mining and Mineral Process Engineering	4	0
or			
25.074	Special Project	4	0
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

		Hpw for Session 1
25.044	Geology IV: Mineral Exploration†§	11
25.054	Geology IV: Sedimentary Basins†	11
25.064	Geology IV: Applied Geophysics†	11

* Field work up to seven days' duration is a compulsory part of this course.
† Prerequisites: 25.013, 25.023 and 25.033.
§ Students taking this option must take 7.023.

School of Chemical Engineering

The School of Chemical Engineering consists of the Departments of Biological Process Engineering, Chemical Engineering, Food Technology and Fuel Technology. The course in Chemical Engineering contains 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.

Food Technology is concerned with the management of foods from the time of production until they reach the consumer. It is the responsibility of the food technologist to see that foods do not spoil or perish. This covers handling, transportation, storage and packaging of fresh and prepared foods and the techniques for preservation such as cold storage, freezing, canning, dehydration and packaging.

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 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 three years of industrial training concurrently with their University work.

Department of Chemical Engineering

304
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 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.

		Hours per week S1	S2
Year 1			
1.001	Physics I	6	6
2.001	Chemistry I	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
Year 2			
2.002A	Physical Chemistry	6	0
2.002B	Organic Chemistry	0	6
2.002C	Inorganic/Analytical Chemistry	3	3
3.111	Chemical Engineering Principles I	2	3
3.112	Chemical Engineering Material Balances and Thermodynamics	3	3
8.112	Materials and Structures	3	3
10.031	Mathematics	2	2
10.331	Statistics SS	2	2
	Two General Studies Electives	3	3
		24	25
Plus *one* of the following electives:			
3.311	Fuel Engineering I	2	2
4.031	Physics of Metals	3	1
25.201	Mineralogy	2	2
44.111	Microbiology	3	3
Year 3			
3.121	Chemical Engineering Principles II	11	3
3.122	Chemical Engineering Thermodynamics and Reaction Engineering	4	2
3.123	Chemical Engineering Design I A and B	2	12
3.124	Chemical Engineering Design and Practice*		
6.801	Electrical Engineering	3	3
10.032	Mathematics	2	2
	General Studies Elective	1½	1½
		23½	23½
Plus *one* of the following electives:			
2.013L	Chemistry and Enzymology of Foods	3	3
3.321	Fuel Engineering II	3	3
4.121	Principles of Metal Extraction	3	3
18.121	Production Management	3	3
22.113	Industrial Chemistry Processes†		
	Any Year 2 elective not previously studied‡		

* The hours for this subject, which is normally conducted throughout the year, cannot be predetermined.

† Less factory visits. These are part of 3.123 Chemical Engineering Design A and B.

‡ Students taking a Year 2 elective at this point may prejudice their honours degree.

Year 4

		Hpw S1	S2
3.131	Chemical Engineering Principles III	3	1
3.132	Chemical Engineering Process Dynamics and Control	5	5
3.133	Chemical Engineering Design II	8	0
	General Studies Advanced Elective	1½	1½
	Project	1	11
		18½	18½

The project to be selected from the following:

3.140	Chemical Engineering Design Project
3.150	Chemical Engineering Experiment Project
3.240	Food Technology Project
3.340	Fuel Engineering Project
3.440	Biological Process Engineering Project

Plus *one or more* of the following electives to a total of 7 hrs/week for 28 weeks.

3.134	Advanced Chemical Engineering Principles*	4	4
3.135	Chemical Engineering Practice*	3	3
3.136	Oil and Gas Engineering	3	3
3.233	Food Technology	7	7
3.331	Fuel Engineering III	4	2
3.332	Fuel Engineering IV	6	2
3.411	Biological Process Engineering	7	7
7.314	Mineral Processing I†	7	6
18.551	Operations Research	3	3
23.051	Nuclear Power Technology	3	3
	Any Year 2 or Year 3 elective not previously studied‡		

* Students taking 3.134 must also take 3.135 and vice versa.
† Students choosing this elective must also take 7.023 Mining and Mineral Process Engineering, Part II (2 hours per week in Session 1).
‡ Students taking Year 2 or Year 3 electives at this point may prejudice their honours degree.

304
Chemical Engineering—Full-time/Part-time Course

Bachelor of Engineering
BE

The BSc(Tech) course in Chemical Engineering was replaced in 1975 by a part-time/full-time course leading to a BE degree to be normally 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 (for details of material covered in Stages 1-6 see 1974 Calendar).

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

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.

304
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 2 the appropriate elective is 44.111 Microbiology; in Year 3 it is 2.013L Chemistry and Enzymology of Foods; and in Year 4, 3.411 Biological Process Engineering, plus 3.440 Biological Process Engineering Project.

Successful completion of this 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 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 course in Chemical Engineering with fuel electives is accepted by the Council of Engineering Institutions, UK, the Royal Australian Chemical Institute, and the Institution of Engineers, Australia, as sufficient academic qualification for corporate membership.

304
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. 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 2 the appropriate elective is 3.311 Fuel Engineering I; and in Year 3 it is 3.321 Fuel Engineering II. In Year 4, 3.331 Fuel Engineering III, 3.332 Fuel Engineering IV and 3.340 the Fuel Engineering Project can be taken.

The final year electives are devoted to professional subjects covering the broad areas of constitution, processing, and utilization of fossil fuels. Topics include studies of the design and performance evaluation of furnaces and boilers, radiation, flames, air pollution, carbonization, refractories, and progress in fuel science and fuel processing.

Department of Food Technology

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

A study of food science and technology demands an interdisciplinary and integrated approach, one that brings many scientific disciplines into focus. Its basis is in areas of chemistry, biochemistry and microbiology, and its borders merge with those of agriculture, engineering, nutrition and commerce.

The food technologist acquires new knowledge by laboratory and process research, and applies it to the development of acceptable foods by optimum processes and equipment. He studies foods 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 Department of Food Technology offers a four-year, full-time course leading to the degree of Bachelor of Science and a six-year part-time course leading to 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.

306
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.

		Hours per week S1	S2
Year 1			
1.001	Physics I	6	6
2.001	Chemistry I	6	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
17.011	Biology of Mankind	6	0
17.021	Comparative Functional Biology	0	6
		24	24
Year 2			
2.002A	Physical Chemistry	6	0
2.002B	Organic Chemistry	0	6
2.002D	Analytical Chemistry	0	6
3.201	Food Technology I	3	3
10.031	Mathematics	2	2
41.101	Biochemistry I (Units A and B)	12	0
44.141	Introductory Microbiology	0	6
	General Studies Elective	1½	1½
		24½	24½
Year 3			
2.043L	Chemistry and Enzymology of Foods	6	6
3.211	Food Technology II	6	3
3.212	Food Technology III	0	12
3.231	Food Engineering I	3	3
10.331	Statistics SS	2	2
44.142	Microbiology	6	0
	General Studies Elective	1½	1½
		24½	27½
Year 4			
3.221	Food Technology IV	7	7
3.250	Project	8	8
	General Studies Elective	1½	1½
	General Studies Advanced Elective	1½	1½

Plus *one or more* of the following electives to a total of not less than 6 hrs/wk

2.003B	Organic Chemistry	6	6
3.222	Oenology	3	3
3.232	Food Engineering II	3	3
18.121	Production Management	3	3
18.551	Operations Research	3	3
28.012	Marketing Models	3	0
28.022	Marketing Systems	0	4
42.102	Fermentation Technology	0	6

or such other electives, to a total of not less than 6 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 student's activities during his period in industry is required, and is taken into account in the classification for the honours list.

307
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 degree of Bachelor of Science (Technology). A minimum of three years' concurrent industrial training is required before graduation.

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 degree of Bachelor of Science (Technology) may proceed to 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 a BSc degree must apply to the Head of the School not later than 31 December of the year in which the sixth stage is completed.

		Hours per week	
Stages 1 and 2*		S1	S2
1.001	Physics I	6	6
2.001	Chemistry I	6	6
10.001	Mathematics I *or*	6	6
10.011	Higher Mathematics I†		
17.011	Biology of Mankind	6	0
17.021	Comparative Functional Biology	0	6
		24	24

* Two of the subjects listed will be taken in first year and the other two in second year (as directed).
† There will be no evening lectures in this subject.

Stage 3			
2.002A	Physical Chemistry	6	0
2.002B	Organic Chemistry	0	6
2.002D	Analytical Chemistry	0	6
10.031	Mathematics	2	2
	Two General Studies Electives	3	3
		11	17

		Hpw	
Stage 4		S1	S2
3.201	Food Technology I	3	3
41.101	Biochemistry I (Units A and B)	12	0
44.141	Introductory Microbiology	0	6
		15	9
Stage 5			
2.043L	Chemistry and Enzymology of Foods	6	6
3.211	Food Technology II	6	3
3.213	Food Engineering I	3	3
		15	12
Stage 6			
3.212	Food Technology III	2	10
10.331	Statistics SS	2	2
44.142	Microbiology	6	0
	General Studies Elective	1½	1½
		11½	13½

307
Food Technology BSc(Tech) Course Full-time/Part-time Study

Bachelor of Science (Technology) BSc(Tech)

Students enrolling in the Food Technology BSc(Tech) course may reduce the time required for completion by undertaking the following program of combined part-time/full-time study:

Stage 1 Part-time (as for BSc(Tech) course above)

Stage 2 Part-time (as for BSc(Tech) course above)

Stage 3A Full-time (as for second year of full-time BSc course above)

Stage 4A Full-time (as for third year of full-time BSc course above)

Stage 5A Part-time (a program of 6-9 hours per week selected from undergraduate subjects on the advice of the Head of the School).

School of Chemical Technology

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 three years of industrial training concurrently with their University work.

Department of Industrial Chemistry

The courses in Industrial Chemistry are concerned with the study of the development, manufacture and use of inorganic and organic industrial chemicals and macromolecules—that special class of materials comprising surface coatings, plastics, elastomers and adhesives. Graduates from these courses are expected to play an effective role in research and development, production control, quality control and technical sales and service.

Arrangements have been made with the University of Wollongong for students who have completed a specified program to be admitted with advanced standing to Year 3 of the Industrial Chemistry course at the University of New South Wales.

Department of Ceramic Engineering

The Department of Ceramic Engineering offers courses designed to provide scientists and engineers fitted for service in industries and organizations concerned with the development, manufacture and use of materials in the fields of: whitewares, structural ceramic products, high-temperature materials, electrical ceramics, glass, ceramic surface coatings, abrasives, cermets and nuclear ceramics. Graduates from these courses would find employment in the general field of ceramics in such capacities as ceramist or ceramic engineer on research and development, production control, quality control, product evaluation or technical sales and service.

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 Ceramic Engineering course at the University of New South Wales.

Department of Polymer Science

The Department of Polymer Science provides instruction in polymer science in the full-time and part-time courses in Industrial Chemistry. These subjects provide a sound treatment of the principles of polymer chemistry and polymer physics, giving Industrial Chemistry students a familiarity with the surface coatings, plastics and rubber industries.

310
Industrial Chemistry—Full-time Course

Bachelor of Science
BSc

Year 1

		Hours per week
1.001	Physics I	6
2.001	Chemistry I	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I	6
Plus one of:		
5.010	Engineering A*† *and*	5
5.030	Engineering C*†	6
17.011	Biology of Mankind* *and*	6
17.021	Comparative Functional Biology*	6
25.011	Geology I	6

* One session only.
† Chemical Technology students take Introduction to Systems and Computers in 5.030 and Materials in 5.010.

Year 2

		Hours per week S1	S2
1.212B	Physics (Electronics)	3	0
2.002A	Physical Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
2.002B	Organic Chemistry	1½	4½
10.031	Mathematics	2	2
10.331	Statistics SS	2	2
22.112	Chemical Process Equipment	1	1
22.122	Instrumental Analysis	3	3
22.132	Industrial Chemistry Calculations	1	1
	General Studies Elective	1½	1½
		21	21

Year 3*

2.003B	Organic Chemistry	6	0
3.111	Chemical Engineering Principles I	2	3
22.113	Industrial Chemistry Processes	3½†	3½†
22.123	Chemical Thermodynamics and Kinetics	3	3
22.133	Data Processing	3	4
22.153	Material and Energy Balances	3	0
22.163	Instrumentation and Process Control I	0	3§
22.303	Polymer Science	2	4†
	Two General Studies Electives	3	3
		25½	23½

* Students who have completed a specified program at the University of Wollongong are admitted with advanced standing to Year 3 at this University.
† Laboratories operate for 4 hour periods in alternate weeks.
§ Laboratories operate for 3 hour periods in alternate weeks.

Year 4		Hours per week S1	S2
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	0	4
22.164	Instrumentation and Process Control II	5	0
22.174	Seminars	3	3
22.184	Process Analysis	1	2
22.194	Project	6	8
	General Studies Advanced Elective	1½	1½
		24½	23½

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.

311
Industrial Chemistry—Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

Stages 1 and 2*		Hours per week
1.001	Physics I	6
2.001	Chemistry I	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I†	6
Plus *one* of:		
5.010	Engineering A‡§ *and*	5
5.030	Engineering C‡§	6
17.011	Biology of Mankind‡ *and*	6
17.021	Comparative Functional Biology‡	6
25.011	Geology I	6

* Two of the first four subjects listed are taken in the first year, the other two in second year (as directed).
† There are no evening lectures in this subject.
‡ One session only.
§ Chemical Technology students take Introduction to Systems and Computers in 5.030 and Materials in 5.010.

Stage 3		Hpw S1	S2
1.212B	Physics (Electronics)	3	0
2.002A	Physical Chemistry	0	6
10.031	Mathematics	2	2
10.331	Statistics SS	2	2
22.112	Chemical Process Equipment	1	1
	General Studies Elective	1½	1½
		9½	12½

Stage 4		Hpw S1	S2
2.002B	Organic Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
22.122	Instrumental Analysis	3	3
22.132	Industrial Chemistry Calculations	1	1
	General Studies Elective	1½	1½
		11½	11½

Stage 5			
3.111	Chemical Engineering Principles I	2	3
22.113	Industrial Chemistry Processes	3½†	3½†
22.153	Material and Energy Balances	3	0
22.303	Polymer Science	2	4 †
		10½	10½

† Laboratories operate for 4 hour periods in alternate weeks.

Stage 6			
2.003B	Organic Chemistry	6	0
22.123	Chemical Thermodynamics and Kinetics	3	3
22.133	Data Processing	3	4
22.163	Instrumentation and Process Control	0	3*
	General Studies Elective	1½	1½
		13½	11½

* Laboratories operate for 3 hour periods in alternate weeks.

302
Ceramic Engineering—Full-time Course

Bachelor of Science
BSc

Year 1		Hours per week S1	S2
1.001	Physics I	6	6
2.001	Chemistry I	6	6
5.010	Engineering A*†	5	0
5.030	Engineering C*†	0	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6
22.231	Introductory Ceramic Engineering‡		

* One session only.
† Chemical Technology students take Introduction to Systems and Computers in 5.030 and Materials in 5.010.
‡ A series of 10 one hour lectures given in Session 2.

Year 2			
1.212B	Physics (Electronics)	3	0
1.212C	Physics (Introduction to Solids)	0	3
2.002A	Physical Chemistry	6	0
2.042C	Inorganic Chemistry	0	6
2.002D	Analytical Chemistry	6	0
8.112	Materials and Structures	3	3
10.031	Mathematics	2	2
10.331	Statistics SS	2	2
	General Studies Elective	1½	1½
		23½	17½

Year 3*

		Hpw S1	Hpw S2
3.111	Chemical Engineering Principles I	2	3
3.311	Fuel Engineering I	2	2
7.023	Part 2, Mineral Process Engineering	2	0
22.123A	Chemical Thermodynamics	3	0
22.153	Material and Energy Balances	3	0
22.213	Chemical Ceramics	4	6
22.2331	Ceramic Process Principles	4	4
22.2332	Ceramic Engineering I	1	1
25.201	Mineralogy	2	3
	Two General Study Electives	3	3
		26	22

* Students who have completed a specified program at the University of Newcastle or at the University of Wollongong will be admitted with advanced standing to Year 3 at this University.

Year 4

18.131	Operations Research	2	0
22.144	Instrumentation and Process Control	8	0
22.224	Physical Ceramics	6	6
22.234	Ceramic Engineering	4	4
22.294	Project	3	12
	General Studies Advanced Elective	1½	1½
		24½	23½

303 Ceramics—Part-time Course

Bachelor of Science (Technology) BSc(Tech)

Stages 1 and 2*

		Hours per week
1.001	Physics I	6
2.001	Chemistry I	6
5.010	Engineering A**§	5
5.030	Engineering C**§	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I†	6
22.231	Introductory Ceramic Engineering‡	

* Two subjects are taken in the first year and the other two in the second year (as directed).
** One session only.
§ Chemical Technology students take Introduction to Systems and Computers in 5.030 and Materials in 5.010.
† There will be no evening lectures in this subject.
‡ A series of 10 one hour lectures given in Session 2.

Stage 3

		Hpw S1	Hpw S2
1.212B	Physics (Electronics)	3	0
1.212C	Physics (Introduction to Solids)	0	3
2.002A	Physical Chemistry	0	6
10.031	Mathematics	2	2
10.331	Statistics SS	2	2
		7	13

Stage 4

		Hpw S1	Hpw S1
2.042C	Inorganic Chemistry	0	6
2.002D	Analytical Chemistry	6	0
8.112	Materials and Structures	3	3
	General Studies Elective	1½	1½
		10½	10½

Stage 5

3.111	Chemical Engineering Principles I	2	3
7.023	Part 2, Mineral Process Engineering	2	0
22.153	Material and Energy Balances	3	0
22.2331	Ceramic Process Principles	4	4
22.2332	Ceramic Engineering I	1	1
	General Studies Elective	1½	1½
		13½	9½

Stage 6

3.311	Fuel Engineering I	2	2
22.123A	Chemical Thermodynamics	3	0
22.213	Chemical Ceramics	4	6
25.201	Mineralogy	2	2
	General Studies Elective	1½	1½
		12½	11½

School of Geography

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 in northern Australia, and economic geographers are engaged as regional planners and market researchers.

Applied Geography—Full-time Courses Bachelor of Science

The School offers three four-year full-time courses leading to the degree of Bachelor of Science, which aim to train professional geographers for entry into applied fields. There are elective specializations in biogeography and economic geography, with emphasis on urban geography, or geomorphology and pedology. 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.

It is recommended that all students spend a period of four to six weeks with organizations concerned with the investigation and planned use of resources *et cetera*.

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Applied Geography—Full-time Course

Bachelor of Science
BSc

Biogeography and Climatology

Year 1		Hours per week S1	S2
2.001	Chemistry I	6	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics I *or*	6	6
10.021	Mathematics IT		
17.011	Biology of Mankind	6	0
17.021	Comparative Functional Biology	0	6
27.001	Applied Physical Geography†	6	6
		24	24

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

Year 2			
1.001	Physics I	6	6
27.011	Applied Economic Geography I (Part 1)‡	6	0
27.862	Australian Environment and Land Resources*	0	5
43.101	Genetics	0	6
43.121	Plant Physiology	0	6
	General Studies Elective	1½	1½
		13½	24½

‡ 1 day of field work, equivalent to 8 tutorial hours, is an essential part of the subject.
* Up to 5 days' field work, equivalent to 40 tutorial hours, are an essential part of the subject.

Year 3			
27.014	Advanced Methods in Physical Geography	2½	2½
27.103	Climatology	0	5½
27.203	Biogeography*	5½	0
27.333	Agricultural Geography* *or*	0	4½
27.413	Geomorphology*	4½	0
27.423	Pedology*	0	4½
43.111	Plant Evolution and Ecology	6	0
43.142	Environmental Botany	6	0
	Two General Studies Electives	3	3
		27½	20

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

Year 4		Hpw S1	S2
27.104	Bioclimatology*	6	0
27.204	Advanced Biogeography*	9	0
27.504	Project (Biogeography and Bioclimatology)	2	16
	General Studies Advanced Elective	1½	1½
		18½	17½

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

Geomorphology and Pedology

For students enrolled for the first time prior to 1974.

Year 4			
25.0303	Geology for Geomorphologists and Pedologists	4	2
27.404	Advanced Geomorphology and Pedology*	9	0
27.504	Project (Geomorphology and Pedology)	2	16
	General Studies Advanced Elective	1½	1½
		16½	19½

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

Geomorphology and Pedology

For students enrolled for the first time in 1974 and thereafter.

Year 1		Hours per week
2.001	Chemistry I	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I *or*	6
10.021	Mathematics IT	
25.011	Geology I	6
27.001	Applied Physical Geography†	6
		24

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

Year 2		Hours per week S1	S2
1.001	Physics I	6	6
25.012	Geology IIA	9	0
25.022	Geology IIB	0	9
27.011	Applied Economic Geography I (Part 1)‡	6	0
27.862	Australian Environment and Land Resources*	0	5
	General Studies Elective	1½	1½
		22½	21½

‡ 1 day of field work, equivalent to 8 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

		Hpw S1	S2
25.0303	Geology for Geomorphologists and Pedologists	4	2
27.103	Climatology	0	4½
27.203	Biogeography*	5½	0
27.413	Geomorphology*	5½	0
27.423	Pedology*	0	5½
27.014	Advanced Methods in Physical Geography	2½	2½
	Two General Studies Electives	3	3
		20½	17½

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

Year 4

27.414	Advanced Geomorphology*	7	0
27.424	Advanced Pedology*	7	0
27.504	Project (Geomorphology and Pedology)	2	16
	General Studies Advanced Elective	1½	1½
		17½	17½

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

Applied Economic Geography

Year 1

		Hours per week
10.001	Mathematics I *or*	6
10.011	Higher Mathematics I *or*	
10.021	Mathematics IT	
15.001	Economics IA *and*	3/4
15.011	Economics IB	
53.101	Sociology IA *and*	3
53.102	Sociology IB	
27.011	Applied Economic Geography I (Part 1)†	6
		18/19

† Two days' field work, equivalent to 16 tutorial hours, is an essential part of the subject.

Year 2

		Hpw S1	S2
15.002	Economics IIA *and*	4	0
15.022	Economics IIB *or*		
15.042	Economics IIC	0	4
27.801	Introduction to Physical Geography†	4½	0
27.002	Applied Economic Geography II‡	0	6

† Two days' field work, equivalent to 16 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.

Plus *two* of the following combinations. The choice of subjects is to be approved by the Head of School.

		Hours per week S1	S2
28.012	Marketing Systems *and*		
28.022	Marketing Models	4	4
28.032	Behavioural Science *and*		
28.042	Consumer Behaviour	4	4
15.601	Economic History IA *and*		
15.611	Economic History IB	3	3
53.203	Sociology IIA *and*		
53.204	Sociology IIB	4½	4½

Year 3

27.013	Advanced Methods in Economic Geography	2½	2½
27.003	Applied Economic Geography III	5/6	0

Plus *three* of the following as available. The choice is to be approved by the Head of School.

27.023	Population Geography*	0	5/6
27.113	Urban Geography*	5/6	0
27.123	Social Geography*†	0	5/6
27.303	Transportation Geography*	0	5/6
27.323	Marketing Geography*	5/6	0
27.333	Agricultural Geography*	0	5/6

Plus *two* of the following Economics options, *one* in each session:

15.053	Economic Development	3	0
15.003	Economics IIIA	3	0
15.023	Economics IIIB	0	4
15.043	Comparative Economic Systems	3	0
15.073	Natural Resource Economics	0	3
15.082	Labour Economics	0	3
15.093	Public Sector Economics	0	3

* Students attend a weekly seminar at Honours level in two of these subjects. Up to 5 days' field work, equivalent to 40 tutorial hours, is an essential part of the subject.
† Subject to availability of staff in 1976.

Year 4

36.411	Town Planning	3	0
27.124	Geographic Thought and Perspectives	3	3
27.304	Advanced Economic Geography	6	0
27.504	Project (Economic Geography)	6	16
		18	19

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

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.

The graduate metallurgist has a wide choice of type of employment and location. He 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, Mt. Morgan, Gladstone, Port Pirie, Whyalla, Kwinana, Kalgoorlie or Pilbara; or in the metal manufacturing plants, including the automobile, aircraft, ship-building 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 men. If the graduate is inclined towards research and development, he 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. The two courses offered at present are a full-time course for the degree of Bachelor of Science (pass or honours) and a part-time course leading to the degree of Bachelor of Science (Technology). A new full-time course leading to the degree of Bachelor of Engineering has been approved. Students enrolled in 1975 in the Bachelor of Science course with the engineering option are able to transfer, if they so desire, to Year 2 of the Bachelor of Engineering course, with full credit for subjects passed. The aim of this 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 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 Australian 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 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.

312
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	6
2.001	Chemistry I	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

Old Course

For students who completed Year 1 before the beginning of Session 1, 1975.

Year 3		**Hours per week**
4.012	Metallurgy II	19
4.813	Mathematical Methods *or*	3
6.801	Electrical Engineering	3
	Two General Studies Electives	3
		25

Year 4		
4.013	Metallurgy III*	18
4.021	Metallurgy Project†	5
	General Studies Advanced Elective	1½
		24½

* Session 2 10
† From Week 12 in Session 1 10
Project includes three weeks' laboratory work during Midyear Recess.

Revised Course

For students who completed Year 1 in 1975.

		Hours per week S1	S2
Year 2 (Operates from 1976)			
2.002A	Physical Chemistry	6	0
4.302	Chemical and Extraction Metallurgy I	5	2
4.402	Physical Metallurgy I	7	6½
4.602	Metallurgical Engineering I	2	6½
4.802	Metallurgical Physics	0	2
10.031	Mathematics II	2	2
25.201	Mineralogy	2	2
	General Elective Studies	1½	1½
		25½	22½
Year 3 (Operates after 1976)			
4.303	Chemical and Extraction Metallurgy II	7	2
4.403	Physical Metallurgy II	10	5
4.613	Metallurgical Engineering IIA	1	3
4.703	Materials Science	0	6
4.813	Mathematical Methods *or*	3	3
6.801	Electrical Engineering	3	3
7.023	Mineral Process Engineering Part 2	2	0
	Two General Studies Electives	3	3
		26	22
Year 4 (Operates after 1976)			
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
4.414	Physical Metallurgy IIIA	4½	0
4.424	Physical Metallurgy IIIB	3	4½
4.504	Mechanical and Industrial Metallurgy	3	9
	General Studies Advanced Elective	1½	1½
		24½	24½

* Project includes three weeks' laboratory work during Midyear Recess.

318
Metallurgical Process Engineering—Full-time Course

Bachelor of Engineering
BE

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

		Hours per week S1	S2
Year 1			
1.001	Physics 1	6	6
2.001	Chemistry I	6	6
10.001	Mathematics I *or*		
10.011	Mathematics I	6	6
5.010	Engineering A *and*	6	0
5.030	Engineering C	0	6
		24	24
Year 2			
2.002A	Physical Chemistry	6	0
4.302	Chemical and Extraction Metallurgy I	5	2
4.402	Physical Metallurgy I	7	6½
4.602	Metallurgical Engineering I	2	6½
4.802	Metallurgical Physics	0	2
10.031	Mathematics II	2	2
25.201	Mineralogy	2	2
	General Studies Elective	1½	1½
		25½	22½
Year 3			
4.303	Chemical and Extraction Metallurgy II	7	2
4.403	Physical Metallurgy II	10	5
4.613	Metallurgical Engineering IIA	1	3
4.623	Metallurgical Engineering IIB	0	6
4.813	Mathematical Methods *or*	3	3
6.801	Electrical Engineering	3	3
7.023	Mineral Process Engineering Part 2	2	0
	Two General Studies Electives	3	3
		26	22
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 Advanced Elective	1½	1½
Plus *one* of the following electives:			
4.414	Physical Metallurgy IIIA	4½	0
7.314	Mineral Processing (Part only)	6	0
		24½/26	24½

* Project includes three weeks' laboratory work during Midyear Recess.

313
Metallurgy—Part-time Course‡

Bachelor of Science (Technology)
BSc(Tech)

The part-time course extends over six years of two sessions each. Students are required to obtain at least three years' approved experience in a metallurgical industry or research establishment concurrently with studies.

During the last three years of the course visits are made to various metallurgical works, and students are required to submit reports on some of these.

Modifications to the full-time BSc course in Metallurgy will necessitate consequential changes in the part-time courses available in the School. The course which is set out below is the present course and it will be revised during 1976. Students who enrolled in Stages 1 or 2 in 1975 may be required to transfer, with advanced standing, to the revised BSc course or the new BE course in 1976.

Stages 1 and 2*

		Hours per week
1.001	Physics I	6
2.001	Chemistry I	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

* Two of the first four subjects listed are taken in first year and the other two in second year.
† There are no evening lectures in this subject.
‡ This course will be revised in 1976.

Stage 3

		Hours per week S1	S2
2.002A	Physical Chemistry	6	0
4.802	Metallurgical Physics	0	2
10.031	Mathematics	2	2
	Two General Studies Electives	3	3
		11	7

Stage 4

		Hours per week
4.011	Metallurgy I	11
25.201	Mineralogy *or*	2
5.010	Engineering A*† *and*	
5.030	Engineering C*†	2
		13

* One session only.
† Part only.

Stage 5

		Hours per week
4.0121	Metallurgy IIA*	9
4.813	Mathematical Methods *or*	3
6.801	Electrical Engineering	3
	General Studies Elective	1½
		13½
*Session 2.		11

Stage 6

		Hours per week
4.0122	Metallurgy IIB*	10½
		10½
*Session 2.		11

313
Metallurgy BSc(Tech) In Full-time/Part-time Study*

Bachelor of Science (Technology)
BSc(Tech)

Students enrolling in the Metallurgy BSc(Tech) course may reduce the time required for completion by undertaking the following program of combined part-time/full-time study:

Stage 1 Part-time (as for BSc(Tech) course above)
Stage 2 Part-time (as for BSc(Tech) course above)
Stage 3A Full-time (as for second year of full-time BSc course above)
Stage 4A Full-time (as for third year of full-time BSc course above)
Stage 5A Part-time (as set out below)

Stage 5A

		Hours per week
4.0123	Metallurgy IIC	4
4.054	Seminar	2
4.0124	Report	0
		6

* This course is subject to revision.

School of Mining Engineering

The School of Mining Engineering offers a full-time course in Mining Engineering leading to the degree of Bachelor of Engineering (pass or honours).

The School also offers a course at graduate level requiring one year of full-time or two years of part-time study leading to the Graduate Diploma (GradDip) in Mining and Mineral Engineering.

Part-time courses are conducted at the W. S. & L. B. Robinson University College, Broken Hill—in Mining Engineering leading to the BSc(Eng) and in Mineral Processing leading to the BSc(Tech)*.

The courses within the School prepare graduates for employment in the mineral industries and in research institutions.

* From 1975 the BSc(Eng) course will be replaced by the BE course over seven stages, consisting of a combination of full-time and part-time studies. Students already enrolled in the BSc(Eng) course will be allowed to complete it.

Since 1850 the mining industry has been a pioneering force in the development of Australia. However the problems of today are complex and require great technical skill.

The mining industry will become, because of its rate of growth, a greater influence in development of this and neighbouring countries. Extensive and successful prospecting is taking place, particularly in those areas which in the past received little attention, and hidden, sub-surface deposits are being discovered. Following the discovery of a promising deposit there is a period of testing, proving and assessment followed by a period of development and construction. Finally, there is the production period with which is associated some extension of activities which include smelting and the establishment of new industries.

314
Mining Engineering—Full-time Course

Bachelor of Engineering
BE

The first two years of the course are similar to the first and second years of the Civil Engineering course. The third year introduces Mining Engineering and Mineral Processing. The fourth year program is concerned with the professional Mining Engineering subjects.

The aim is to give students a thorough foundation in mining engineering and so permit them to enter "quarrying ", "coal mining", "metalliferous mining" or the "petroleum industry", and to be employed in any of the phases of these industries, ranging from exploration to production in a technical or managerial role.

To cater for the varied needs of the industry and to develop the special talents of individual students, it is possible in the final year of the course to do advanced work in either Mining Engineering or Mineral Processing. In addition, during the final year of the course students are given a project linked with the mineral industry elective for which a thesis must be submitted.

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 the school and in the final year project.

In the undergraduate course it is compulsory for students to gain practical experience in the mineral industry during successive long recesses. The minimum requirement of 100 days is to be completed prior to entering Year 4. Students are advised, however, to gain mining experience in excess of the minimum specification in order to facilitate fulfilment of experience requirements for the State Mines Department, Mine Managers Certificates of Competency in both Coal and Metalliferous Mining under the *Coal Mines Regulation Act No. 37, 1912* and the *Mines Inspection Act No. 75,1901* respectively.

The industrial training requirement should be completed in the recesses following completion of academic Years 1, 2 and 3.

After graduation it is normal for mining engineers to obtain the above-mentioned statutory certificate of competency from one of the State Government Departments of Mines. Graduates in Mining Engineering are examined principally in the applications of the above-mentioned Acts.

It is possible for students to undertake the First and Second Years of the BE course on a part-time basis.

Year 1

		Hours per week S1	S2
1.001	Physics I	6	6
2.001	Chemistry I *or*		
2.021	Chemistry IE**	6	6
5.010	Engineering IA*	6	0
5.020	Engineering IB**	0	6
5.030	Engineering IC*	0	6
10.001	Mathematics I *or*		
10.011	Higher Mathematics	6	6
		24	30

* One session only. Students will take this subject in either Session 1 or 2.
** When 5.020 Engineering IB is included with Engineering IA and IC then 2.021 Chemistry IE will be taken.

Year 2

		Hours per week
4.941	Materials	1
5.611	Fluid Mechanics/ Thermodynamics I	3
6.801	Electrical Engineering	3
7.012	Mineral Resources Parts 1 and 2	1
8.172	Mechanics of Solids II*	4
8.250	Properties of Materials	2
10.022	Engineering Mathematics II	4
25.101	Geology for Engineers†§	4
29.441	Engineering Surveying†	6
29.491	Survey Camp‡	0
	General Studies Elective	1½

* Session 1 only.
† Session 2 only.
§ Two one-day Geology excursions are an essential part of the course
‡ Students are required to attend a one week Survey Camp, equivalent to 40 class contact hours.

Note: One half of the students take the subjects 4.941, 25.101 and 5.611 in Session 1 and the subjects 8.250 and 8.172 in Session 2. The other half take these subjects in reverse order of sessions.

Year 3

		Hours per week for Session 1
7.023	Mining and Mineral Process Engineering—Parts 1 and 2	4
7.113	Mining Engineering I	8
7.213	Mine Surveying and Control Engineering	2
25.102	Geology for Engineers II*	8
	General Studies Elective	1½
		23½

* A Geology excursion is conducted at the end of the session.

Note: After Session 1 students are required to obtain industrial experience. They write a report on this which is assessed first by their employers and then by the School. The range of experience obtained and the report submitted is considered when grading degrees at the end of the course.

Year 4		Hours per week S1	S2
7.124	Mining Engineering II*	6	6
7.134	Mining Engineering III *or*	4	0
7.324	Mineral Processing II		
7.144	Mining Engineering IV *or*	0	4
7.334	Mineral Processing III		
7.224	Mine Valuation	2	0
7.234	Mineral Economics	0	2
7.314	Mineral Processing I*	6	6
7.414	Mineral Industry Elective Project	5	5
	General Studies Advanced Elective†	3	3
		26	26

* Examined in two parts.
† An additional General Studies Elective may be included in Year 4.

421
Mining Engineering—Part-time Courses

Bachelor of Science (Engineering BSc(Eng)

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

The School of Mining Engineering offers a part-time course in Mining Engineering, leading to the degree of Bachelor of Science (Engineering). From 1975 the BSc(Eng) course will be replaced by the BE course over seven stages, consisting of a combination of full-time and part-time studies. Students already enrolled in the BSc(Eng) course will be allowed to complete it.

Stages 1 and 2		Hours per week
1.001	Physics I	6
2.001	Chemistry I	6
2.021	Chemistry IE	6
5.010	Engineering IA†	6
5.020	Engineering IB	6
5.030	Engineering IC†	6
10.001	Mathematics I *or*	
10.011	Higher Mathematics I	6

† One session only. Students will take this subject in either Session 1 or 2.

Stage 3		Hpw S1	S2
4.941	Materials	2	0
7.012R	Mineral Resources—Parts 1 and 2	1	1
8.151	Mechanics of Solids	3	3
8.250	Properties of Materials	0	4
10.022	Engineering Mathematics II	4	4
		10	12

Stage 4		Hpw
5.611	Fluid Mechanics/ Thermodynamics	4
7.023R	Mining and Mineral Process Engineering, Parts 1 and 2*	2
	General Studies Elective	1½
25.101	Geology for Engineers‡	2
29.441	Engineering Surveying†	3
		12½

* Consists of 44 lectures and also four visits, each of three hours, to mines or mineral processing plants.
‡ Two short Geology excursions are an essential part of the course.
† Includes 42 hours of practical work.

Stage 5		
6.801	Electrical Engineering	3
7.113R	Mining Engineering I	4
7.213R	Mine Surveying and Control Engineering	1
25.1021	Geology for Mining Engineers*	4
	General Studies Elective	1½
		13½

* Geology excursion will be conducted during the year.

Stage 6		
7.124R	Mining Engineering II*	5
7.315R	Mineral Processing for Mining Engineers	3
7.414R	Mineral Industry Elective Project†	2
	General Studies Elective	1½
		11½

* A mining excursion of five days is conducted during the year.
† Project for an award with merit is more advanced than that required for the award of the pass degree.

422
Mineral Processing—Part-Time Course

Bachelor of Science (Technology) BSc(Tech)

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

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 degree of Bachelor of Science Technology. A minimum of three years' concurrent industrial training in approved industries is required before graduation.

From 1975 the BSc(Tech) course will be replaced by the BE course over seven stages, consisting of a combination of full-time and part-time studies. Students already enrolled in the BSc(Tech) course will be allowed to complete it.

Stages 1 and 2

		Hours per week S1	S2
1.001	Physics I	6	6
2.001	Chemistry I	6	6
2.021	Chemistry IE	6	
5.010	Engineering IA†	6	6
5.020	Engineering IB		6
5.030	Engineering IC†	5	5
10.001	Mathematics I *or*		
10.011	Higher Mathematics I	6	6

† One session only. Students take this subject in either Session 1 or 2.

Stage 3

2.002A	Physical Chemistry I	6	0
4.941	Materials	2	0
8.250	Properties of Materials	0	4
10.022	Engineering Mathematics II	4	4
	General Studies Elective	1½	1½
		13½	9½

Stage 4

		Hpw
2.002D	Analytical Chemistry I	3
7.023R	Mining and Mineral Process Engineering—Parts 1 and 2*	2
10.331	Statistics SS	2
25.101	Geology for Engineers†	2
25.201	Mineralogy	2
		11

* Course consists of 44 lectures, and four visits, each of three hours, to mines or mineral processing plants.
† Two short Geology excursions are an essential part of the course.

Stage 5

6.801	Electrical Engineering	3
7.314R	Mineral Processing I—Parts 1 and 2	6
7.411	Fluid Mechanics	2
	General Studies Elective	1½
		12½

Stage 6

7.316R	Mineral Processing II	7
7.326R	Mineral Industry Processes, Parts 1 and 2	2
7.414R	Mineral Industry Elective Project†	2
	General Studies Elective	1½
		12½

† The Project for an award with merit is more advanced than that required for the award of the pass degree.

School of Textile Technology

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 required to undertake a minimum of eight weeks' industrial training during the long recesses between Years 2 and 3, and 3 and 4.

317
Textile Technology—Full-time Course

Bachelor of Science
BSc

		Hours per week
Year 1 (All courses)		
1.001	Physics I *or*	
1.011	Higher Physics I	6
2.001	Chemistry I	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
10.331	Statistics SS	2
13.111	Textile Technology I	8
13.211	Textile Science I	3
	General Studies Elective	1½
		25½

Year 3

2.003B	Organic Chemistry	6
2.003H	Molecular Spectroscopy and Structure	
13.112	Textile Technology II	13
13.212	Textile Science II	2
13.311	Textile Engineering I	1
	Two General Studies Electives	3
		25

Textile Physics

Year 2

		Hpw
1.112A	Electromagnetism *or*	6
1.122A	Electromagnetism *and*	
1.112B	Modern Physics *or*	
1.122B	Quantum Physics	
1.112C	Thermodynamics and Mechanics *or*	2
1.122C	Thermodynamics and Mechanics	
10.111A	Linear Algebra *or*	2
10.121A	Algebra	
10.111B	Analysis *or*	2
10.121B	Real and Complex Analysis	
10.211A	Mathematical Methods *or*	2½
10.221A	Mathematical Methods	
10.331	Statistics SS	2
13.111	Textile Technology I	8
13.211	Textile Science I	3
	General Studies Elective	1½
		29

Year 3

1.113A	Wave Mechanics and Spectroscopy	7
1.113B	Electromagnetic Fields and Physical Optics	
1.113C	Statistical Mechanics and Solid State	
1.113D	Astrophysics and Nuclear Physics	
	or	
1.123A	Quantum Mechanics	
1.123B	Electromagnetic Theory and Statistical Methods	
1.123C	Solid State and Nuclear Physics	
1.123D	Atomic Physics and Spectroscopy	
13.112	Textile Technology II	13
13.212	Textile Science I	2
13.311	Textile Engineering I	1
	Two General Studies Electives	3
		26

Textile Engineering

		Hpw S1	Hpw S2
Year 2			
5.020B	Engineering Mechanics II	4	0
5.311	Engineering Mechanics	0	2
5.611	Fluid Mechanics/ Thermodynamics	0	2
8.112	Materials and Structures	3	3
10.022	Engineering Mathematics	4	4
10.331	Statistics SS	2	2
13.111	Textile Technology I	8	8
13.211	Textile Science I	3	3
	General Studies Elective	1½	1½
		25½	25½

Year 3

		Hpw
5.111	Mechanical Engineering Design	4
5.331	Dynamics of Machines I	2
6.801	Electrical Engineering	3
13.112	Textile Technology II	13
13.212	Textile Science II	2
13.311	Textile Engineering I	1
	Two General Studies Electives	3
		28

Textile Manufacture

		Hpw S1	Hpw S2
Year 2			
10.331	Statistics SS	2	2
12.101	Psychology	3	3
13.111	Textile Technology I	8	8
13.211	Textile Science I	3	3
14.501	Accounting and Financial Management IA	4	
14.511	Accounting and Financial Management IB		4
15.001	Economics IA	4	
15.011	Economics IB		4
	General Studies Elective	1½	1½
		25½	25½

Year 3

		Hpw
13.112	Textile Technology II	13
13.212	Textile Science II	2
13.311	Textile Engineering I	1
14.081	Introduction to Business Finance	2
26.124	Psychology	1½
28.012	Marketing Systems	
28.022	Marketing Models	4
	General Studies Elective*	1½
		25

* Not to include Economics or Psychology.

Year 4 (All courses)

13.113	Textile Technology III	6½
13.213	Textile Science III	5
13.312	Textile Engineering II	1½
13.411	Project	7
	Optional*	2
	General Studies Advanced Elective	1½
		23½

* 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

Motivated by strong competition from cheaply-produced man-made fibres, wool producers, by the implementation of the Wool Use Promotion Act of 1945 and subsequent legislation, have undertaken a program to improve efficiency through research, increased extension services, and adequate publicity for wool. The full development of this program requires specialist personnel trained to give service to the pastoral industry.

To meet this need the School of Wool and Pastoral Sciences offers a full-time course in Wool and Pastoral Sciences, leading to the degree of Bachelor of Science (pass or honours).

From 1972 the School provided the course in Wool and Pastoral Sciences (Education Option), previously offered under the title "Sheep and Wool Technology (Education Option)" within the then Board of Professional Studies. The purpose of the course is to provide training at the tertiary level for teachers of sheep husbandry and wool science in the Department of Technical Education and in the Agricultural High Schools and Colleges. Students who complete the course successfully will be eligible to become certificated teachers. Graduates could proceed to higher degrees in the field of Rural Extension or of certain scientific aspects of the pastoral industry.

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 Graduate Diploma in Wool and Pastoral Sciences. Research may also be undertaken for the degrees of Master of Science and Doctor of Philosophy.

The Wool and Pastoral Sciences courses aim to provide a pool of graduates with a liberal scientific outlook, and the habit of exact and logical thought. These graduates will be familiar with the latest developments in the various fields relating to Wool and Pastoral Sciences and the utilization of the products stemming from the industry. Graduates of the School are keenly sought after for positions as research workers, teachers, extension workers, agricultural journalists, valuers, and managers of estates, and for other professional occupations in the pastoral industry.

The first year of the BSc course consists of a basic training in general science; vocational subjects essential to all branches of the wool industry are given in the second, third and fourth years. The fourth year work includes a project which will give each student an opportunity to express initiative and originality. By association with lecturers, and teachers who are all engaged in research, we aim to provoke both curiosity and interest in students who will themselves endeavour to contribute to the advance of efficiency.

In Years 3 and 4 provision is made for students who wish to specialize in Plant Sciences, Animal Production, Wool Technology, Farm Management and Economics or in the appropriate scientific areas of Genetics and Biostatistics, Physiology, Nutrition and Biochemistry, Rural Extension, Agricultural Chemistry or Parasitology.

From time to time compulsory field excursions, farm tours and consolidated courses on University field stations are arranged for students.

Requirements for Industrial Training

Each student is required to complete satisfactorily twenty-four weeks' practical work on approved sheep properties, sixteen weeks of which work should be concurrent with the course. If a student has done practical work before entering the course, this may be taken into consideration in determining any further work required. Students in the Education Option are also required to obtain in Years 3 and 4 the equivalent of three hours per week classroom experience in Agricultural High Schools and/or the Department of Technical Education.

In order to obtain recognition of practical work carried out students shall:

1. Make application for the approval of the properties where they intend to carry out the practical work. Students should endeavour to obtain experience in the pastoral, sheep-wheat, and high rainfall zones;

2. At the conclusion of each period of work, produce certificates from employers stating periods of employment and reporting on the quality of the student's work;

3. Supply reports as hereunder:

A On work carried out in the long vacation:

1. monthly interim reports setting out briefly the nature of the work engaged in, with any notes of topical interest; and
2. a final report on both the district and property, to be submitted within one month of resumption of lectures.

B On work carried out in short vacations: a brief report to be submitted within one week of the resumption of the session.

C On work carried out for twenty-four weeks on a property or properties:
1. Interim reports to be submitted every two months.
2. Final reports to be submitted by March 31 in the year of resumption of studies. The nature of the interim and final reports shall be as required for work carried out in the long vacation.

322
Wool and Pastoral Sciences—Full-time Course

Bachelor of Science
BSc

Year 1		Hours per week
2.001	Chemistry I	6
10.001 10.011 10.021	Mathematics I *or* Higher Mathematics I *or* Mathematics IT	6
17.011	Biology of Mankind†	6
17.021	Comparative Functional Biology†	6
27.001	Geography*	6

† One session only.
* Students wishing to specialize in Wool Science or Wool Technology may substitue 1.011 Higher Physics I or 1.001 Physics I for 27.001 Geography I.

Year 2		Hpw
9.121	Livestock Production I	3
9.221	Agronomy	4
9.411	Agricultural Chemistry I	4
9.531	Wool Technology I	7
9.601	Animal Physiology I	5
10.331	Statistics SS	2
	General Studies Elective	1½
		26½

Year 3		Hours per week S1	S2
9.131	Animal Health and Preventive Medicine I	0	3
9.231	Pastoral Agronomy	2	4
9.311	Agricultural Economics I	2	0
9.801	Genetics I	2	3
41.101A	Chemistry of Biologically Important Molecules	6	0
41.101B	Metabolism	6	0
41.101C	Control Mechanisms	0	6
	Two General Studies Electives	3	3
		21	19

Plus at least *two* of the following subjects in each session as approved by the Head of the School (maximum 26 hours):

		Hpw	
9.122	Livestock Production II	2	0
9.123	Livestock Production III	0	2
9.232	Crop Agronomy	0	2
9.312	Agricultural Economics II	0	2
9.313	Farm Management I	2	0
9.314	Farm Management II	0	2
9.316	Analysis of Rural Development Projects	0	2
9.532	Wool Technology II (Wool Study)	2	2
9.533	Wool Technology III (Wool Metrology)	3	3
9.534	Wool Technology IV (Raw Materials)	0	2
9.602	Animal Physiology II	2	2

Year 4			
9.001	Project	6	6
9.811	Biostatistics	4	4
	General Studies Advanced Elective	1½	1½

Plus subjects providing at least 12 hours per week of lecture, tutorials and laboratory work in each session, selected from the following. The choice of subjects is to be approved by the Head of the School.

9.124	Livestock Production IV	2	2
9.132	Animal Health and Preventive Medicine II	3	0
9.232	Crop Agronomy	0	2
9.412	Agricultural Chemistry II	6	6
9.421	Animal Nutrition	3	0
9.535	Wool Technology V	2	2
9.536	Wool Technology VI	4	4
9.603	Animal Physiology III	4	4
9.802	Genetics II	4	4
9.901	Rural Extension	4	4
9.312	Agricultural Economics II	0	2
9.313	Farm Management I	2	0
9.314	Farm Management II	0	2
9.315	Farm Management III	2	0
9.316	Analysis of Rural Development Projects	0	2
43.121	Plant Physiology	0	6
43.142	Environmental Botany	6	0

Table of Progression in Subjects

Year 1		Year 2		Year 3		Year 4	
27.001	Geography I	9.221	*Agronomy*	9.231	*Pastoral Agronomy*	9.232 43.121 43.142	Crop Agronomy Plant Physiology Environmental Botany
17.011 17.021	*Biology of Mankind* *Comparative Functional Biology*	9.061 9.121	*Animal Physiology I* *Livestock Production I*	9.602 9.122 9.123 9.131	Anim. Physiol. II L'stck Prodn. II L'stck Prodn. III *Animal Health and Prev. Medicine I*	9.603 9.421 9.123 9.132	Anim. Physiol. III Anim. Nutrition L'stck Prodn. III Anim. Health and Prev. Medicine II
2.001	*Chemistry I*	9.411	*Agricultural Chemistry I*	41.101	*Biochemistry I*	9.412	Agric. Chemistry II
10.001 10.011 10.021	*Mathematics I*	10.331	*Statistics SS*	9.801	*Genetics I*	9.811 9.802	*Biostatistics* Genetics II
				9.311 9.312 9.313 9.314 9.316	*Agricultural Economics I* Agricultural Economics II Farm Management I Farm Management II Analysis of Rural Development Projects	9.312 9.313 9.314 9.315 9.316 9.901	Agric. Economics II Farm Management I Farm Management II Farm Management III Analysis of Rural Development Projects Rural Extension
1.001 1.011	Physics I	9.531	*Wool Technology I*	9.532 9.533 9.534	Wool Technology II Wool Technology III Wool Technology IV	9.535 9.536	Wool Technology V Wool Technology VI

NOTE
1. Students may take either Geography I or Physics I.
2. Subjects in italics are compulsory.
3. Course requires yearly progression and apart from compulsory subjects, there are no co- or prerequisites.

321
Wool and Pastoral Sciences (Education Option)—Full-time Course

Bachelor of Science
BSc

Years 1 and 2 of this course are the same as for the existing BSc degree course in Wool and Pastoral Sciences.

Year 3		Hours per week S1	S2
9.122	Livestock Production II	2	0
9.123	Livestock Production III	0	2
9.131	Animal Health and Preventive Medicine I	0	3
9.231	Pastoral Agronomy	2	4
9.311	Agricultural Economics I	2	0
9.313	Farm Management I	2	0
9.801	Genetics I	2	3
44.101	Introductory Microbiology	3	3
58.401	Education IA	4	3
58.061	Methods of Teaching*	3	3
	Two General Studies Electives	3	3
		23	24

* 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			
9.124	Livestock Production IV	2	2
9.132	Animal Health and Preventive Medicine II	3	0
9.232	Crop Agronomy	0	2
9.312	Agricultural Economics II	0	2
9.315	Farm Management III	2	0
9.421	Animal Nutrition	3	0
43.101C	Plant Physiology	0	6
58.062	Methods of Teaching*	3	3
58.402	Education IIA	5	5
	Seminar and Thesis on Educational Issues	2	2
	General Studies Advanced Elective	1½	1½
		21½	23½

* 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 Enrolment Procedures

Graduate Study

Qualifying Programs
(for admission to Higher Degree Candidature)

Students may only enrol in such programs after approval has been obtained from the relevant Higher Degree Committee.

Unless advised to the contrary, successful applicants are required to attend for enrolment at the appropriate time and place as listed below. The letter offering a place must be taken to the enrolment centre.

Candidates who are continuing a qualifying program are required to attend for re-enrolment at the appropriate time and place as listed below.

Note: All qualifying students must lodge an authorized enrolment form with the Cashier on the day the enrolling officer signs the form. (See Enrolment Procedures earlier in this handbook.)

Friday 27 February
2.00 pm to 5.00 pm
6.00 pm to 8.00 pm
Office of the appropriate School

Higher Degree Research Programs

New Students
Students seeking admission to Higher Degree (Research) must make application on the appropriate form which should be submitted to the Registrar. *Successful applicants will be advised by letter concerning the method of enrolment.*

Re-enrolling Students
Candidates registered for Higher Degrees (Research) are required to re-enrol at the commencement of each academic year. **Unless advised to the contrary candidates should obtain re-enrolment forms and advice on procedure and fees from the office of the appropriate School** after 1 January 1976. Each candidate must complete a re-enrolment form and submit it to the Cashier. (See Enrolment Procedures earlier in this handbook.)

A candidate who has completed all the work for a graduate degree except for the submission of a thesis is required to re-enrol as above *unless* the thesis is submitted by 13 March 1976, in which case the candidate is not required to re-enrol.

Masters and Graduate Diploma Courses

Note: All formal masters and graduate diploma students must lodge an authorized enrolment form with the Cashier on the day the enrolling officer signs the form. (See Enrolment Procedures earlier in this handbook.)

New Students
Students seeking admission to formal masters courses and graduate diploma courses are required to apply on the appropriate form and by the closing date specified for the particular course. Unless advised to the contrary successful applicants are required to attend for enrolment at the appropriate time and place as shown under **Qualifying Programs.** The letter offering a place must be taken to the enrolment centre.

Re-enrolling Students
Candidates continuing formal graduate courses, including those who have completed their formal examination but have not submitted their project report, are required to attend for re-enrolment at the appropriate time and place as listed under **Qualifying Programs.**

Graduate Study

The Faculty provides facilities for students to proceed to 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 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.

Numbers of 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, Fuel Technology, Polymer Technology, Mining and Mineral Engineering and Wool Technology.

Courses leading to the degree of Master of Applied Science and to 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 in the Calendar.

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

802
Hydrogeology-Engineering Geology Graduate Course

Master of Applied Science
MAppSc

The purpose of this course, which leads to the Master of Applied Science, is to train graduates who have a suitable background as specialist Hydrogeologists and Engineering Geologists. It is designed to provide a bridge between Civil Engineering and Geology for graduates who wish to study and work in the field of water resources or civil engineering geology.

The normal requirement for admission is completion of a four year degree course in Geology. Other graduates with suitable academic and professional attainments may be permitted to register.

The program may be completed in either one year on a full-time or two years on a part-time basis. The course consists of both subjects of Group A, *one* subject from Group B and *two* subjects from Group C.

Group A

25.034	Engineering Geology (Geomechanics)
25.403G	Project

Group B

25.121G	Engineering Geology
25.402G	Hydrogeology
25.404G	Environmental Geology

Group C

25.421G	Foundation Geology
25.701G	Subsurface Geology and Pollution Control

and *either*

27.901G	Geomorphology for hydrologists

or

27.904G	Geomorphology for engineering geologists
8.753G	Soil Mechanics I
8.708G	Finite Element Methods in Civil Engineering I

807
Applied Geophysics Graduate Course*

Master of Applied Science
MAppSc

The Master of Applied Science 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.

A student may be admitted to the MAppSc course in Applied Geophysics provided that he is a four-year graduate in Science, Applied Science or Engineering, or has an equivalent qualification, and provided further that he has 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.

* Not available in 1976.

809
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:

7.023	Mining and Mineral Process Engineering
25.014	Exploration Geophysics and Mathematical Geology
25.337G	Geophysical Procedures
25.338G	Computer Applications in Exploration Geology
25.339G	Geology in Exploration
25.340G	Geochemical Prospecting
25.341G	Remote Sensing
7.001G	Exploratory Drilling
25.343G	Mineral Economics, Mining Law and Management
25.141	Advanced Engineering Geology *or*
4.121	Principles of Metal Extraction
25.000G	Special Laboratory Project
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 Master of Applied Science or to 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.

Graduate Courses Specializing in:

800
Biological Process Engineering

801
Chemical Engineering

803
Food Technology

804
Environmental Pollution Control*

806
Fuel Technology

808
Industrial Pollution Control

Master of Applied Science
MAppSc

The MAppSc 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 and Fuel Technology; Biological Process Engineering and Food Technology.

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 courses specializing in Biological Process Engineering and Food Technology are primarily intended for graduates in Agriculture, Applied Science, and Science with principal

* For additional information see below.

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 in the Calendar), 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 given in Section D of the Calendar.

804
Environmental Pollution Control Graduate Course*

Master of Applied Science
MAppSc

The graduate course in Environmental Pollution Control leads to 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 in Chemical Engineering and Industrial Chemistry who have completed a four year degree program, 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.

		Hours per week
1.		
3.170G	Process Principles or Graduate Elective	2
2.		
3.162G	Urban Planning	½
3.164G	Medical Aspects	1
3.166G	Legislative Aspects	1
27.902G	Meteorological and Hydrological Principles	1
44.111	Microbiology	3
3.		
3.163G	Industrial Use and Re-use of Water	1½
3.242G	Treatment and Utilization of Biological Effluents	2
3.391G	Atmospheric Pollution and Control	2
3.396G	Unit Operations in Waste Management	1½
	Optional Elective(s) *and*	3

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

		Hpw
3.901G	Pollution Elective *or*	3
3.900G	Project	

3.170G Process Principles is a bridging course 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 specified 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 Pollution Elective must be embodied in a report and submitted in accordance with the requirements of the School.

501
Corrosion Technology Graduate Diploma Course

Graduate Diploma
GradDip

The Graduate Diploma course in Corrosion Technology is open to graduates in Engineering, Applied Science or Science who wish to undertake formal studies to promote their careers in industry. At present it may only be taken as a two year part-time course.

The course is designed for those professionals in industry who are faced with the problem of combating corrosion. Its aim is to develop an appreciation of the fundamentals, principles of corrosion and of the available methods of overcoming it.

For graduates from Engineering (non-chemical) or Science (in a particular major) a bridging course is a necessary introduction to the graduate level of certain subjects. For this purpose the subject, 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.

		Hours per week
Year 1		
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.

		Hours per week
Year 2		
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

† This is the weekly equivalent of total hours for the subject. These hours may, however, be concentrated in one period.

502
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
3.201	Food Technology I	1
3.211	Food Technology II	2
3.212	Food Technology III	2
3.213G	Food Process Laboratory	3
3.243G	Food Technology Seminar	2
	Electives*	8
		18

* Electives are to be selected from the following list of subjects, according to availability and with the approval of the Head of the School. The hours for these electives must include at least four devoted to graduate subjects.

		Hpw
2.271G	Chemistry and Analysis of Foods	3
3.231	Food Engineering I	2
3.232	Food Engineering II	3
3.242G	Treatment & Utilization of Biological Effluents	2
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

or such other electives, to a total of 3 hours/week, approved by the Head of School.

503
Fuel Technology Graduate Diploma Course

Graduate Diploma
GradDip

The Graduate Diploma Course in Fuel Technology has been designed to provide professional training and specialisation in fuel science and engineering for graduates in science, applied science or engineering who have not had previous training in this field.

Holders of the Graduate Diploma in Fuel Technology are exempted from the examination required for admission to corporate membership of the Institute of Fuel. Applicants holding an appropriate degree or equivalent qualification in science, applied science or engineering are eligible for admission to the course. They may also be required to undertake assignments or successfully complete examinations as directed by the Head of the School.

The Graduate Diploma in Fuel Technology (GradDip) is awarded on the successful completion of one year of full-time study (18 hours per week) or two years of part-time study (9 hours per week). The course is a blend of formal lectures and laboratory work at undergraduate and post-graduate levels.

		Hours per week
1. *Introductory Stage (up to 9 hours per week)*		
3.381	Principles of Fuel Technology	3
3.382	Combustion Engineering	3
3.383	Fuel Plant Evaluation and Assignments	3
		9

Full-time Course

2. *Advanced Stage (up to 9 hours per week)*		
3.390G	Graduate Seminar	1
	Advanced Electives*	8
		9

* Subjects to be selected from the following according to availability and specialization required:

3.391G	Atmospheric Pollution and Control	2
3.392G	Fuel Science	3
3.393G	Fuel Engineering Plant Design	3
3.394G	Thermal Engineering and Fuel Processing	3
3.395G	Research Techniques and Extension Methods	2
3.396G	Unit Operations in Waste Management	1

When appropriate, up to three hours per week may be selected from approved courses offered by other Schools within the University, eg Coal Preparation, Instrumentation and Automatic Control, Ceramics, Nuclear Engineering, etc.

School of Chemical Technology

880
Chemical Technology Graduate Course

Master of Applied Science
MAppSc

The aim of this course in 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 percent of the total program. This would include a project constituting not less than 15 percent and not more than 30 percent of the program.

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

Undergraduate material may be included in one or both strands but may not exceed 25 percent of the total program. Approximately 60 percent 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	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*

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.

* These subjects operate for *two* sessions at the stated hours per week.

School of Metallurgy

The School of Metallurgy conducts courses which may 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 for the degrees of Master of Science, Master of Engineering and Doctor of Philosophy.

The Head of the School will be 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.

805
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 aproximately twenty hours per week for two sessions full-time.

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

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

Graduate Subjects

		Hours per week*
4.241G	Graduate Metallurgy Project	Not less than 4
4.211G	Metallurgical Practice	4 to 8
	Detailed studies relating to one or more of the following:	

		Hpw
	1. Extractive Metallurgy	
	2. Metal working and forming	
	3. Foundry practice	
	4. Welding and metal fabrication	
	5. Metal finishing and corrosion protection	
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 courses 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 prerequisite and co-requisite requirements 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).

504
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 of full-time or two years of 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.

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. Normally, the program will be arranged so that it may be completed in one year full-time or two years part-time. It should be noted that some degree of specialization will be possible in the laboratory investigations.

		Hours per week	
Year 1—Part-time		S1	S2
7.023	Mining and Mineral Process Engineering, Parts 1 and 2	4	
7.033	Mineralogical Assessment	1	
7.234	Mineral Economics		2
7.311G	Mineral Beneficiation		3
7.111G	Mining Engineering		3
		5	8
Year 2—Part-time			
7.122G	Mining Engineering Technology *or*	6	
7.322G	Mineral Beneficiation Technology	6	
7.132G	Mining Engineering Laboratory and Project *or*		6
7.332G	Mineral Engineering Laboratory		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.

School of Wool and Pastoral Sciences

508
Wool Technology Graduate Diploma Course

Graduate Diploma
GradDip

The course leading to the award of the Graduate Diploma in Wool Technology 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.

Recently the course was made more flexible to permit prospective students to specialize in particular graduate aspects of Wool and Pastoral Sciences, and at the same time, to do supporting work in related undergraduate fields which they may not have covered in their undergraduate training, or which they may have covered and wish to revise.

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 in the basic disciplines of the undergraduate BSc degree course, viz. General and Human Biology, Agronomy and/or Livestock Production. Such qualifying examination will be of a standard which will ensure that the student has sufficient knowledge of the subject and the principles involved to profit by the course.

The following program may be completed either in one year on a full-time basis or over two years on a part-time basis. Students are required to carry out full-time study or its equivalent 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.

Full-time Course

		Hours per week
9.105G	Advanced Livestock Production	4
9.503G	Wool Study	6
9.711G	Advanced Wool Technology	4
9.902G	Techniques of Laboratory and Field Investigation	4
	Approved undergraduate subjects	8

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.

545 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 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. Students take part in a case-study program and staff from the Schools of the Faculty of Applied Science participate so that effective application of the principles of the course can be made to a student's own special industry.

Subject Descriptions and Textbooks

The following pages contain a list of most of the subjects offered for courses in the Faculty of Applied Science. In general, the list is arranged according to subject numbers and the School responsible for the subject.

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.

Students are required to have their own copy of the prescribed Textbooks. Lists of Reference Books for additional reading, and of Textbooks, where not given here, are issued by the Schools. For General Studies subjects see the Board of General Studies Handbook, which is available free of charge.

Information Key

The following is the key to the information supplied about each subject listed below:
S1 (Session 1); S2 (Session 2); S1 + S2 (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).

Identification of Subjects by Numbers

Each subject provided by a School has an identifying number. The integer is the identifying number of the School and the numbers after the decimal point distinguish the subject from others conducted by that School, some of which may have the same name. For example, Physics I has several variations. The subject number 1.001 denotes Physics I and is the physics subject included in first year Applied Science, Science and Engineering course programs; 1.011 is the corresponding subject at a higher level; 1.081 is the special Physics I subject included in the first year Medicine course; and so on.

As well as providing a clear means of identifying subjects with the same or similar names, the subject number is also used in the recording of enrolment and examination information on machine data processing equipment. It is therefore emphasized that students should cite both the correct subject name, subject number and course code in all correspondence or on forms dealing with courses.

You should become familiar with the identifying numbers of the subjects listed in this handbook:

Identifying Number	School, Faculty or Department
1	School of Physics
2	School of Chemistry
3	School of Chemical Engineering
4	School of Metallurgy
5	School of Mechanical and Industrial Engineering
7	School of Mining Engineering
8	School of Civil Engineering
9	School of Wool and Pastoral Sciences
10	School of Mathematics
12	School of Psychology
13	School of Textile Technology
14	School of Accountancy
15	School of Economics
17	Biological Sciences
18	Department of Industrial Engineering
22	School of Chemical Technology
23	School of Nuclear Engineering
25	School of Applied Geology
26	Department of General Studies
27	School of Geography
28	School of Marketing
29	School of Surveying
36	School of Town Planning
41	School of Biochemistry
42	School of Biological Technology
43	School of Botany
44	School of Microbiology
53	School of Sociology
58	School of Education

See the Calendar for the full list of subjects and their identifying numbers and for summaries of the disciplines taught in each School or Department.

School of Physics

Undergraduate Study

Physics Level I units

1.001
Physics I* S1 + S2 L3T3

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.

The application of wave and particle theories in physics. A review of the atomic theory of matter and the structure and properties of atomic nuclei. 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.

Textbook

Weidner R. T. & Sells R. L. *Elementary Physics, Classical and Modern* Allyn & Bacon

* Students in the Faculty of Applied Science who have not reached a sufficient standard for further study in Physics but whose performance is otherwise satisfactory may be granted a pass in 1.071 Physics IT.

1.011
Higher Physics I S1 + S2 L3T3

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.

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

Textbooks

Russell G. J., & Mann K. *Alternating Current Circuit Theory* NSWUP
Weidner R. T. & Sells R. L. *Elementary Physics, Classical and Modern* Allyn & Bacon

1.071
Physics IT

See footnote to 1.001 Physics I.

Physics Level II units

1.112A
Electromagnetism S2 L2½T3½

Electrostatics and magnetostatics in vacuum and in dielectrics. Magnetic materials. Maxwell's equations and simple applications.

Textbook

Parton J. E. & Owen S. J. T. *Applied Electromagnetics* Mac Press

1.112B
Modern Physics S1 L2½T3½

Special theory of relativity, Lorentz transformation, relativistic mass momentum and energy: Schrödinger wave equation expectation values, operators, eigenfunctions, eigenvalues, free-particle, bound-particle and applications to physical systems, spectra, electron spin, spin-orbit coupling, exclusion principle, origins and spectra of X-rays, electron energy levels in solids.

Textbook

Arya A. P. *Elementary Modern Physics* Addison-Wesley

1.112C
Thermodynamics and Mechanics S1 + S2 L1½T½

Thermodynamics: First and second laws of thermodynamics. Thermodynamic functions and simple applications. Statistical foundations of thermodynamics. Kinetic theory of gases.

Mechanics: Properties of solids and liquids, elasticity, hydrostatics, hydrodynamics, vibration of systems with one degree of freedom, S.H.M., superposition, damped S.H.M., forced vibration, resonance, Fourier analysis, vibrations of coupled systems, Lagranglan mechanics, oscillations of continuous systems, waves, wave packet group velocity.

Textbooks

French A. P. *Vibrations and Waves* Nelson
Mandl F. *Statistical Physics.* Wiley
Stephenson R. J. *Mechanics and Properties of Matter* Wiley

Higher Physics Level II units

1.122A
Electromagnetism S2 L2½T3½

Further electrostatics. Poisson's and Laplace's equations. Ferromagnetism. Maxwell's equations and application to waves in isotropic dielectrics. Poynting vector.

Textbook

Lorrain P. & Corson D. *Electromagnetic Fields and Waves* 2nd ed Freeman

1.122B
Quantum Physics S1 L2½T3½

Syllabus as for 1.112B but treated at a higher level and including some solid state physics.

Textbook

Eisberg R. M. *Fundamentals of Modern Physics* Wiley

1.122C
Thermodynamics and Mechanics S1 + S2 L1½T½

Thermodynamics: As for 1.112C Thermodynamics but at higher level and with some additional topics. *Mechanics:* Oscillations and forced vibrations, Lagrange's equation, variational principles, Hamilton's equations.

Textbooks

Mandl F. *Statistical Physics* Wiley
Symon K. R. *Mechanics* 2nd ed Addison-Wesley

Terminating Physics Level II units

1.212
Physics 11T

Comprises both units 1.212B and 1.212C.

1.212 B Electronics — S1 L1T2

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.

Textbook

Smith R. J. *Circuits, Devices and Systems Theory* 2nd ed Wiley

1.212C
Introduction to Physics of Solids — S2 L2T1

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

Textbook

Rudden M. N. & Wilson J. A. *Simplified Approach to Solid State Physics* Butterworths

1.113B
Electromagnetic Fields and Physical Optics — S2 L2½T3½

Wave equation; propagation in dielectrics and ionized media; reflection and transmission; guided waves, coherence of radiation; interaction of radiation with matter; stimulated emission; laser oscillators; properties of laser light; interferometry; diffraction; convolution theorem X-ray and neutron diffraction.

Textbook

Lipson H. & Lipson S. S. *Optical Physics* C.U.P.

1.113C
Statistical Mechanics and Solid State — S1 L2½T3½

Thermodynamic potentials, ensembles and partition functions, lattice vibrations, the grand canonical ensemble, Pauli exclusion principle, Bose-Einstein and Fermi-Dirac distributions.

Structure of crystals, imperfections, specific heat. Band theory of solids, semiconductors.

Textbooks

Blakemore J. S. *Solid State Physics* Saunders
Jackson E. A. *Equilibrium Statistical Mechanics* Prentice-Hall
Mandl F. *Statistical Physics* Wiley

Higher Physics Level III units

1.123A
Quantum Mechanics — S1 L2½T3½

Concepts, measurements, expectation values, wave mechanics, matrix mechanics, free particle and barrier problems, hydrogen atom spin, exclusion principle, stationary and time dependent perturbation methods, scattering. Born approximation and partial waves.

Textbook

Gasiorowicz S. *Quantum Physics* Wiley

1.123B
Electromagnetic Theory and Statistical Mechanics — S1 L2½T3½

Metallic boundary conditions, eigenfunctions and eigenvalues, cavities, wave guides, scattering by a conductor wave equation for potentials, radiation fields, Hertz potential, dipole and multipole radiation, radiated energy and angular momentum.

Statistical mechanics: Kinetic theory, the Boltzmann equation, Maxwell-Boltzmann distribution, Boltzmann's H-theorem, classical statistical mechanics: postulates, equipartition, ensembles, difficulties; quantum statistical mechanics; postulates, ensembles, Fermi and Bose statistics.

Textbooks

Lorrain P. & Corson D. *Electromagnetic Fields and Waves* 2nd ed Freeman
Reif F. *Fundamentals of Statistical and Thermal Physics* McGraw-Hill.

1.123C
Solid State and Nuclear Physics — S2 L2½T3½

Crystallography, binding energy, phonons, lattice conduction, free electron gas, band theory.

Nuclear models, binding energy, nuclear forces, elementary particles, nuclear reactions, radioactive decay.

Textbooks

Burcham W. E. *Nuclear Physics and Introduction* Longmans
Kittel C. *Introduction to Solid State Physics* 4th ed Wiley

Physics Level III units

1.113A
Wave Mechanics — S1 L2½T3½

Concepts and formulation, finite wells and barriers, tunnelling, harmonic oscillator and applications, hydrogen atom, perturbations, systems of identical particles, electron states in complex systems, bonding, molecules, periodic solids.

Textbooks

No set texts.

School of Chemistry

Undergraduate Study

2.001
Chemistry I — S1 + S2 L2T4

Classification of matter and theories of the structure of matter. Atomic structure, the periodic table and chemical behaviour. Chemical bonding, molecular structure and stereochemistry. Chemical kinetics and equilibrium; enthalpy, free energy and entropy changes in chemical systems. The structure, nomenclature and properties of organic and inorganic compounds. Reactions of organic and inorganic compounds.

Textbooks

Aylward G. H. & Findlay T. J. V. eds *SI Chemical Data* Wiley
Chemistry I Laboratory Manual NSWUP
De Puy C. H. & Rinehart K. L. *Introduction to Organic Chemistry* 2nd ed Wiley Int
Mahan B. H. *University Chemistry* 3rd ed Addison-Wesley

2.002A
Physical Chemistry — S1 or S2 L3T3

Prerequisites: 1.001 or 1.011 and 2.001 and 10.001, 10.011 or 10.021.

Thermodynamics: First, second and third laws of thermodynamics; statistical mechanical treatment of thermodynamic properties; applications of thermodynamics: chemical equilibria, phase equilibria, 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: Adsorption, properties of dispersions; macromolecules and association colloids.

Textbooks

Barrow G. M. *Physical Chemistry* 3rd ed McGraw Hill
Shaw D. J. *Introduction to Colloid and Surface Chemistry* 2nd ed Butterworths

2.002B
Organic Chemistry — S1 or S2 L3T3

Prerequisite: 2.001.

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.

Textbooks

Morrison R. T. & Boyd R. N. *Organic Chemistry* 3rd ed Allyn & Bacon
Vogel A. I. *Elementary Practical Organic Chemistry* Pt II Qualitative Organic Analysis Longman (only if proceeding to further study of Organic Chemistry).

2.002C
Chemistry II (Inorganic/Analytical Chemistry) — S1 or S2 L2T4

Prerequisite: 2.001.

Chemistry of non-metals; chemistry of typical metals; transition metals, lanthanides and actinides; introduction to nuclear chemistry. Quantitative inorganic analysis.

Textbooks

Bard A. J. *Chemical Equilibrium* Harper Int
Quagliano J. V. & Vallarino L. M. *Coordination Chemistry* Heath

2.002D
Analytical Chemistry — S1 or S2 L2T4

Prerequisites: 2.001 and 10.001, 10.011 or 10.021.

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.

Textbooks

Eckschlager K. *Errors and Measurements in Chemical Analysis* R. A. Chalmers trans ed Van Nostrand
Ewing G. W. *Instrumental Methods of Chemical Analysis* McGraw-Hill
Fischer R. B. & Peters D. G. *Quantitative Chemical Analysis* Saunders

2.003B
Organic Chemistry — S1 or S2 L2T4

Prerequisite: 2.002B.

Alicyclic Chemistry: Stereochemistry of acyclic systems; classical and non-classical strain in cyclic systems; stereochemistry and conformation of monocyclic and polycyclic compounds; synthesis, reactions and rearrangement of monocyclic compounds, including stereochemical selectivity; transannular reactions in medium rings. Synthesis and reactions of fused and bridged polycyclic systems.

Heterocyclic Chemistry: Synthesis and reactions of the following heteroaromatic systems: pyridine, quinoline, isoquinoline. Flavones and isoflavones; pyrimidine; pyrrole, furan, thiophen. Indole, imidazole.

Textbooks

Morrison R. T. & Boyd R. N. *Organic Chemistry* 3rd ed Allyn & Bacon
or
Roberts J. D. & Caserio M. C. *Basic Principles of Organic Chemistry* Benjamin
Joule J. A. & Smith G. F. *Heterocyclic Chemistry* Van Nostrand Reinhold
McQuillin F. J. *Alicyclic Chemistry C.U.P.*
Vogel A. I. *Elementary Practical Organic Chemistry* Pt II Qualitative Organic Analysis Longman
Whittaker D. *Stereochemistry and Mechanism* Clarendon

2.003H
Molecular Spectroscopy and Structure — S1 or S2 L3T3

Prerequisite: 2.001.

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.

Textbook

Silverstein R. M. Bassler C. G. & Morrill T. C. *Spectrometric Identification of Organic Compounds* 3rd ed Wiley

2.013L
Chemistry and Enzymology of Foods — S1 + S2 L1T2

Prerequisite: 2.002B. Excluded: 2.003L, 2.033L, 2.043L.

The chemistry of food constituents at an advanced level and the relationship between the chemistry and enzymology associated with the origin and handling of foodstuffs. Treatment of the stability of constituents, changes in colour and texture occurring during processing and storage. Methods of assessment, chemical and physical.

General classification of constituents, role of free and combined water. Fixed oils and fats, rancidity of enzymic and autoxidative origin, antioxidants—natural and synthetic—theories on mechanisms of action, carbohydrates reactivity, role in brewing processes, carbohydrate polymers, starch structure, enzymic susceptibility and mode of action, estimations, enzymic degradation and enzymic browning, reactions and stability of natural pigments, vitamins, preservatives.

Textbooks

No set texts. A list of reference books is provided.

2.021
Chemistry IE — S1 or S2 L3T3

A terminating subject for students in the Aeronautical, Civil, Electrical, Industrial, Mechanical and Mining Engineering, and Naval Architecture courses.

Classification of matter and theories of the structure of matter. Atomic and molecular structure, the periodic table and chemical behaviour.

Chemical bonding and the nature and properties of chemical systems. Equilibrium and energy changes in chemical systems. Introduction to colloidal systems.

Textbooks

Aylward G. H. & Findlay T. J. V. eds *SI Chemical Data* Wiley
Barrow G. M. Kenney M. E. Lassila J. D. Litle R. L. & Thompson W. E. *Understanding Chemistry* Benjamin
Brescia F. Arents J. Meislich H. & Turk A. *Fundamentals of Chemistry* 3rd ed Academic
Chemistry IE Laboratory Manual NSWUP

2.042C
Inorganic Chemistry — S1 or S2 L2T4

Prerequisite: 2.001.

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.

Textbooks

Jolly W. L. *The Chemistry of the Non-Metals* Prentice-Hall
Larsen E. M. *Transitional Elements* Benjamin
or
Cotton F. A. & Wilkinson G. *Advanced Inorganic Chemistry* 2nd ed Wiley

2.043L
Chemistry and Enzymology of Foods

Prerequisite: 2.002B. Excluded: 2.003L, 2.033L, 2.013L.

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

Textbook

No set text. A list of reference books is provided.

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.

3.101
Computation and Modelling in Applied Chemistry

Simple computer models for ecological systems, based on chemical data and physico-chemical properties. A familiarity with elementary computer programming and differential equations is presupposed.

Textbook

Dickson T. R. *The Computer and Chemistry* Freeman

3.111
Chemical Engineering Principles I

1. *Fluid Mechanics:* Introduction and units. Definition and properties. Statics: pressure distribution and pressure measurements. Dynamics: Euler and Bernoulli equations, momentum equation; laminar and turbulent flow, steady flow in pipes and equipment, pressure losses. Flow metering.

2. *Fluid Pumping:* Piping, fittings and valves. Blow cases, air lift pumps, reciprocating pumps, centrifugal pumps and gear pumps. Gas blowers.

3. *Heat Transfer:* 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. Evaporation and crystallization.

4. *Elementary Boundary Layer Theory:* Boundary layer concepts, velocity profiles and boundary layer thickness in laminar and turbulent flow on plates and in pipes. Shear stresses in boundary layers. Heat and momentum analogies: Reynolds, Prandtl-Taylor, Chilton and Colburn.

5. *Dimensional Analysis Scale-up and Theory of Models:* Dimensions; dimensionless numbers; dimensional analysis; static and dynamical similarity; regime concepts; use of models for scale-up. Pilot plants.

Textbooks

Coulson J. M. & Richardson J. *Chemical Engineering* Vol. 1 Pergamon
Holman J. P. *Heat Transfer* 4th ed McGraw-Hill ISE
McCabe W. L. & Smith J. C. *Unit Operations of Chemical Engineering 2nd ed McGraw-Hill*
Massey B. S. Mechanics of Fluids 2nd ed Van Nostrand-Reinhold
Perry, J. H. *Chemical Engineers' Handbook* 5th ed McGraw-Hill

3.112
Chemical Engineering Material Balances and Thermodynamics

Material balances. Basic thermodynamic principles leading to Phase Rule. P-v-T relationships. Energy balances. Further thermodynamic principles leading to phase and reaction equilibrium.

Textbooks

Perry J. H. ed. *Chemical Engineers' Handbook* 5th ed McGraw-Hill
Smith J. M. & Van Ness H. C. *Introduction to Chemical Engineering Thermodynamics* 3rd ed McGraw-Hill

3.121
Chemical Engineering Principles II

Mass Transfer: Mechanisms of mass transfer by diffusion and convection. Two film, surface renewal and penetration theory models for mass transfer. Stage and transfer unit calculations applied to solid-liquid, gas-liquid, liquid-liquid, solid-gas and vapour-liquid operations.

Heat Transfer: An extension of the work covered in 3.111 with an emphasis on the fundamentals of convection and condensation. Unsteady state conduction; introduction to heat exchange design.

Flow of Fluid-Solid Systems: Flow of solids in fluids; sedimentation. Flow of fluids in solids; packed beds; single and two phase flow. Fluidization. Pneumatic conveying.

Digital and Analogue Computations: A short introduction to digital and analogue computers and their uses.

Textbooks

Blatt J. M. *Introduction to Fortran IV Programming* Prentice-Hall
Coulson J. M. & Richardson J. F. *Chemical Engineering* Vol 2 Pergamon
Holman J. P. *Heat Transfer* 3rd ed McGraw-Hill ISE
Perry J. H. *Chemical Engineers' Handbook* 5th ed McGraw-Hill
Peterson G.R. *Basic Analog Computation* Collier Macmillan

3.122
Chemical Engineering Thermodynamics and Reaction Engineering

Thermodynamics: The application of basic material from 3.112 to selected processes and operations. Sources of data, methods of estimating, determining consistency of, and methods of presenting data. Applications of thermodynamics to specific systems, i.e. vapour-liquid, non-electrolyte solutions, aqueous electrolyte solutions and gas-solid systems. Thermodynamic analysis of processes. Irreversible thermodynamics, statistical thermodynamics and thermodynamics of adsorption and desorption.

Reaction Engineering: Homogeneous reactions: **1.** interpretation of batch reactor data and testing of mechanisms **2.** isothermal ideal reactor design A single reactions B multiple reactions **3.** adiabatic ideal reactor design—single and multiple reactions—optimization. Heterogeneous reactions including **1.** flow models—dispersion—mixing residence time distribution **2.** reactor design in non-catalytic fluid/solid reactions, catalytic fluid/solid reactions and fluid/fluid reactions. A selection of topics from **1.** mass transfer with chemical reaction **2.** reactor stability **3.** optimal reactor design **4.** analysis of reactor/reactions.

Textbooks

Levenspiel O. *Chemical Reaction Engineering* 2nd ed Wiley
or
Smith J. M. *Chemical Engineering Kinetics* 2nd ed McGraw-Hill
Smith J. M. & Van Ness M. C. *Introduction to Chemical Engineering Thermodynamics* 3rd ed McGraw-Hill

3.123
Chemical Engineering Design IA and IB

Process Vessels: Mechanical design and fabrication of pressure vessels. Code and legal requirements. Design of supports for vertical and horizontal vessels.

Heat Exchangers: Thermal design procedures for shell and tube heat exchangers and fin-fan coolers. Service fluids for heating and cooling duties.

Mass Transfer Equipment: Construction and design of sieve and other type trays for plate towers. Design and construction of packed towers; selection of packing; performance characteristics of packed and plate towers.

Plant Layout; Reticulation and Fluid Transfer Systems: Arrangement of equipment, fluid prime movers, valves and piping for process and service fluids. Overhead and underground piping. Commercial pipes and tubes; components, flanges and couplings. Construction, shop and field fabrication. Characteristics of common valve types, their sizing and selection. Sizing of pipes. Characteristics of fluid prime movers and associated piping systems.

Process Engineering: Block diagrams, process flowsheets, presentation of material properties, mass and energy flows at various points. Engineering flowsheets. Process engineering (or performance) specifications for equipment items. Storage and safety considerations. The design report.

Chemical Engineering Economics: 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, capitalised cost, optimisation. Depreciation and taxation and their effect on economic analyses. Economic design.

Process Measurements and Control: The principles of operation and use of the basic industrial measuring instruments. Fundamentals of feedback control, leading to the analysis and synthesis of single-loop linear systems.

Corrosion and Materials: A short course covering the theory of corrosion and materials of construction.

Textbooks

Backhurst J. R. & Harker J. H. *Process Plant Design* Heinemann
Coughanowr D. R. & Koppel L. B. *Process Systems Analysis and Control* McGraw-Hill
Kern D. Q. *Process Heat Transfer* McGraw-Hill
Mott L. C. *Engineering Materials for M.E.T.* Part 2 OUP
Perry J. H. ed *Chemical Engineers' Handbook* 5th ed McGraw-Hill
Peters M.S. & Timmerhaus K. D. *Plant Design and Economics for Chemical Engineers* 2nd ed McGraw-Hill
Rase H. F. *Piping Design for Process Plants* Wiley
Treybal R. E. *Mass Transfer Operations* 2nd ed McGraw-Hill
Uhlig H. H. *Corrosion and Corrosion Control* Wiley
A.S. 1210-1972 *Unfired Pressure Vessels* Standards Assoc. of Australia
Doc. 1300 Australian Requirements for Boilers, Pressure Vessels and Gas Cylinders Standards Assoc. of Australia

3.124
Chemical Engineering Design and Practice

Design Report: A design report which is a test of 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 principal unit operations in series (eg 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.

Industrial Process Report: The Industrial Process Report is an exercise in which the student collects up-to-date information regarding a process which is in current use in Australia. He must report on its history, present state and future with particular respect to the scale, raw materials, alternative and competing end products, and processes. The final report is a compilation of material copied directly from the literature.

3.131
Chemical Engineering Principles III

Combined Heat Mass and Momentum Transfer: An advanced theoretical treatment of situations where the various forms of interfacial transport occur simultaneously; fundamental consideration of units such as cooling towers and spray driers; modification to usual transport equations under high flux conditions. *Transport Phenomena:* The equations of conservation (mass, energy, momentum) and their solution in simple applications; the transport coefficients; the energy mass and momentum analogy. *Optimization:* A treatment with examples of such topics as: single and multiple dimension search techniques including Simplex EVOP, linear programming, dynamic programming, introduction to other optimization techniques.

Computer Methods and Modelling: Brief review of Fortran programming, and an introduction to computer operating systems, disc storage, efficient programming methods; numerical methods for roots of equations, solution of linear algebraic equations, ordinary differential equations and partial differential equations; error propagation; search methods, sorting, table-look-up; analogue simulation, and the use of specialized computer programs such as CSMP; introduction to other high-level programs and PLI.

Textbooks

Beveridge G. S. & Schechter R. S. *Optimization Theory and Practice* McGraw-Hill
Bird R. B. Stewart W. E. & Lightfoot E. N. *Transport Phenomena* Wiley
Pennington R. H. *Introductory Computer Methods and Numerical Analysis* Macmillan

3.132
Chemical Engineering Process Dynamics and Control

Problem formulation for lumped- and distributed-parameter dynamic systems, and their mathematical description. Linear dynamic behaviour, stability criteria. Analysis of non-linear systems by linearization and numerical methods. Experimental characterization of systems. Comparison of methods of analysis and synthesis of feedback systems. Multi-loop linear systems. State-space methods. Laboratory.

Textbook

Coughanowr D. R. & Koppell L. B. *Process Systems Analysis and Control* McGraw-Hill

3.133
Chemical Engineering Design II

1. *Process Engineering Strategy:* The creation and screening of alternative processes. The structure of process systems. The treatment of uncertainties in data. Failure tolerance. Engineering around variations. Case studies. Practical and flexural aspects of plant layout and piping arrangements. **2.** *Chemical Reactor Design:* Models for non-ideal homogeneous and heterogeneous systems. Non-ideal homogeneous reactors. Non-catalytic fluid-solid reactors. Solid-catalyzed fluid reactors, reactor instabilities. **3.** *Economic Selection Criteria:* Methods based on discounted cash flows. Comparison of methods, applications and taxation effects. New ventures, replacements, lease and purchase studies. Cost of capital, investment types, evaluation of risk, simulation, ranking of investments, sizing for future developments, case studies.

Textbooks

Levenspiel O. *Chemical Reaction Engineering* 2nd ed Wiley
Peters M. S. & Timmerhaus K. D. *Plant Design and Economics for Chemical Engineers* 2nd ed McGraw-Hill
Rudd D. F. & Watson C. C. *Strategy of Process Engineering* Wiley

3.134
Advanced Chemical Engineering Principles

Advanced Stagewise Operations: Brief review of conventional graphical calculation methods of Ponchon-Savarit and McCabe-Thiele type; phase equilibrium relationships for liquid-vapour and liquid-liquid systems; experimental methods, correlating equations, prediction methods (the case where more than two phases exist will be treated descriptively); graphical treatment of ternary distillation systems; multi-component separations; methods of Lewis-Matheson and Thiele-Geddes; detailed discussion of more modern computational methods; processes separation of binary azeotropes; heat economization; azeotropic and extractive distillation. *Advanced Fluid and Particle Mechanics:* Selected topics in fluid mechanics with relevance to chemical engineering. *Advanced Diffusion and Separation. Advanced Heat Transfer.* Advanced treatment of convective heat transfer and heat exchanger design. Case studies of unusual heat transfer problems. Investigation of unusual heat transfer devices. Associated experimental laboratory studies.

Textbooks

Bird R. B. Stewart W. E. & Lightfoot E. N. *Transport Phenomena* Wiley
Massey B. S. *Mechanics of Fluids* 2nd ed Van Nostrand-Reinhold

3.135
Chemical Engineering Practice

Specialized measurement techniques, experimental techniques, planning of experiments and analysis of engineering data. The use of the literature; information retrieval. The ethical, legal and social obligations of the engineer. Safety; pollution control. Integration of multi-unit complexes; seminar assignment, involving the presenting and discussion of recent chemical engineering papers. Analytical optimization of processes. Associated experimental laboratory studies.

3.136
Oil and Gas Engineering

Effects of temperature and pressure on the properties, thermodynamics and hydrodynamics of hydrocarbon materials. Design applications in the transport, storage and processing of oil and gas products.

3.140
Chemical Engineering Design Project

The design of plant for the production of chemicals and the estimation of product costs.

3.150
Chemical Engineering Experimental Project

An experimental investigation of some aspects of chemical engineering.

Department of Food Technology

3.201
Food Technology I — L1T2

Introduction to food technology. Domestication, breeding and propagation of cultivated plants. Morphology, physiology and biochemistry of plants, horticultural factors, maturity assessment, harvesting, post-harvest handling and storage, storage disorders of fruit and vegetables.

Textbook

Janick J. *Horticultural Science* 2nd ed Freeman *or* Janick J. Schery R. W. Woods F. W. & Ruttan V. W. *Plant Science* Freeman

3.211
Food Technology II — L1½T3

Introduction to food microbiology. Principles of food preservation. Thermal processing, process evaluation. Technology of frozen and dehydrated foods. Preservation by the use of salt, sugar, acid and chemical preservatives. Juices, concentrates, non-alcoholic fermentations. Use of ionizing radiations.

Textbooks

Duckworth R. B. *Fruit and Vegetables* Pergamon
Earle R. L. *Unit Operations in Food Processing* Pergamon
Frazier W. C. *Food Microbiology* 2nd ed McGraw-Hill
Hersom A. C. & Hulland E. D. *Canned Foods: an Introduction to their Microbiology* Churchill

3.212
Food Technology III — L2T6

The science and technology of meat, fish, eggs, milk, fats and oils, cereals, sugars; their derived products, with particular reference to sources, structure and composition, microbiological and biochemical aspects, their reactions and modifications during processing and storage. Food package requirements. Food spoilage, its diagnosis and control.

Textbooks

Frazier W. C. *Food Microbiology* 2nd ed McGraw-Hill
Kent N. L. *Technology of Cereals* 2nd ed Pergamon
Knight J. W. *The Starch Industry* Pergamon
Lawrie R. A. *Meat Science* 2nd ed Pergamon

3.221
Food Technology IV — L3T4

The characteristics of food quality. Colour, texture, flavour, their subjective and objective assessment. Food additives and toxicology, product development, quality control and factory management. Public health, food hygiene and food legislation. Utilization and disposal of food process wastes. Enology. Principles of nutrition.

3.222
Oenology — L1T2

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 assessment; quality control and analytical procedures; distillation and production of fortifying spirit and brandy; world wine industry, wine organizations, wine literature; social uses of alcohol.

3.231
Food Engineering I — L2T1

An introduction to fluid mechanics, heat transfer, mass transfer with applications relevant to the food industry.

Textbooks

Earle R. L. *Unit Operations in Food Processing* Pergamon
Kay J. M. *An Introduction to Fluid Mechanics and Heat Transfer* 2nd ed C.U.P.

3.232
Food Engineering II — L3T0

Fundamental and applied aspects of engineering in selected food processing operations. Food plant and machinery. Process control of food plant. Introduction to engineering economics. Plant experimentation. Design aspects of equipment for effluent treatment.

3.233
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.

3.240
Food Technology Project (Chemical Engineering) — L0T6

Project in Food Technology for students in Chemical Engineering.

3.250
Food Technology Project — L0T8

The student will undertake 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.

Department of Fuel Technology

3.311
Fuel Engineering I

Fuels and Energy, Sources and Properties: Fossil fuels: coal, oil, gas; origin, geology, occurrence in Australia; storage, sampling and analysis; properties and their significance; classification. *Energy Conversion:* An introduction to the combustion of gaseous, liquid and solid fuels; design principles and types of steam-raising plant. *Fuel Processing:* Crude oil, refinery flow patterns, general methods of gas making, carbonization and the production of metallurgical coke. *Steam, Power and Work Cycles:* Heat engines, thermodynamic properties of working fluids.

Textbooks

Macrae J. C. *An Introduction to the Study of Fuel* Elsevier
Mayhew Y. R. & Rogers G. F. C. *Thermodynamic Properties of Fluids and Other Data* Basil & Blackwell

3.321
Fuel Engineering II

Combustion of Gaseous Fuels: Basic principles, kinetics, chemical, physical and aerodynamic considerations; an introduction to flames. *Combustion of Liquid and Solid Fuels.* Heterogeneous combustion reactions; combustion in fuel beds, particles in suspension and of 'atomized' fuels. Mineral impurities; deposits and corrosion. *Principles of Gasification:* Thermodynamics of basic reactions and calculations of equilibrium compositions. The production of fuel and synthesis gases, controlled furnace atmospheres; gas purification. *Fuel Plant Technology:* Introduction to furnaces, ovens, kilns and steam generators. Thermodynamics of heating processes; recoverable and returnable heat in fuel systems. Industrial water.

Textbook

Spiers H. *Technical Data on Fuel* W.P.C. London.

3.331
Fuel Engineering III

Fuel Plant Design: Furnace design for continuous and intermittent operations. Recuperator, regenerator and waste heat boiler design. Process heat transfer. Steam: condensers, evaporators. *Thermal Engineering:* Advanced heat transfer engineering, including numerical and analogue methods of problem solution with applications directed towards the design and performance of combustion appliances and furnaces. Gas and flame behaviour in combustion systems; the use of similarity criteria and models as computation aids.

Textbooks

Holman J. P. *Heat Transfer* 3rd ed McGraw-Hill
Kern D. Q. *Process Heat Transfer* McGraw-Hill
McAdams W. H. *Heat Transmission* McGraw-Hill
Trinks W. *Industrial Furnaces* Vols 1 and 2 Wiley

3.332
Fuel Engineering IV

Flames: Carbon formation, radiation, temperature calculation and measurement; characteristics of industrial flames. *Secondary Fuels and Refractories. Carbonization:* Evaluation of coals, blending, additives; liquid fuels; evaluation, physical properties, specifications; refractories; raw materials, types, thermal, mechanical and chemical properties. *Atmospheric Pollution:* Nature of pollutants, sources, sampling, measurement, physiological effects; plume dispersal; effect of meteorological conditions; industrial gas cleaning, air quality standards and Clean Air Legislation.

Fundamental Constitution of Fuels: Constitution and classification of mineral oils; coal petrology; techniques and application; physical and chemical fine structure of coal.

Textbooks

Gaydon A. & Wolfhard H. *Flames* Chapman & Hall
Krevelen D. W. van. *Coal, Typology, Chemistry, Physics and Constitution* Elsevier

3.340
Fuel Engineering Project

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.

Department of Biological Process Engineering

3.411
Biological Process Engineering

Basic theory and applications of chemical engineering principles to the production of biological materials.

3.440
Biological Process Engineering Project

Project in Biological Process Engineering for students in Chemical Engineering.

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 Use and Re-Use of Water

Water sources, surface waters, ground waters—water quality, removal of gaseous, solid, solute and odorous contaminants. Physical and chemical treatments, softening plant, demineralization, plant design. Water collection and distribution, corrosion and its prevention, industrial contaminants and their removal, water-re-use in plant. Clean up before release, legal requirements. Costs and economics of supply and disposal.

3.164G
Medical Aspects

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

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.

3.165G
Process Optimization

Statistical evaluation of process parameters including significance and effect on objective. Experimental optimization techniques for dealing with stochastic processes. The application of selected programming techniques for determination of optimum process conditions for deterministic processes.

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

A number of 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, chromium, 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, freshwater, 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 will present material arising from literature and /or laboratory assignments and industrialists will be invited to contribute papers and/or participate in the colloquia.

3.176G
Corrosion Literature Review

Students will be 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 will undertake a project involving the design/evaluation of corrosion testing equipment/techniques. A comprehensive report will be 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 nonlinear systems, eg, chemical reactors, flow systems, radiant heat transfer. Numerical solutions. Phase plane analysis. Limit cycles.

3.182G
Process Optimization

Aspects of analytical optimization. The calculus of variations. The discrete and continuous maximum principles. Approach to complex systems: dynamic programming and decomposition techniques. Examples of the use of optimization methods in the chemical process industries.

3.183G
Thermodynamics, Kinetics and Mechanism

Thermodynamics, kinetics and mechanism of proton transfer and electron transfer reactions, particularly with reference to selected industrial processes.

Chemical kinetic theories and empirical analysis of reaction rates. Particular emphasis is given to mechanistic analysis in terms of kinetics and the equilibrium state and steady-state approximation methods. Experimental techniques and treatment of data.

3.184G
System Simulation and Control

Topics to be dealt with will be selected from the following areas: Numerical methods for digital simulation and computation; Programming languages for system modelling; Unsteady-state distributed-parameter systems; Advanced analogue computer methods; Digital computers in data-logging and control; Digital logic and instrumentation; Advanced control systems: eg, system identification, multiloop systems, non-linear systems, sampled-data systems.

3.185G
Interphase Mass Transfer

Advanced theories of mass transfer. The effect of interfacial instability and methods for predicting its presence. Gas absorption with chemical reaction. Mass tranfer into froths and foams. 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. Multiparticulate systems with homo- and heterogeneously sized particles. Co-current systems. Limiting particle transport velocity, instabilities, various criteria. Transport line feed systems, transport line driers and reactors. 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

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.

3.188G
Advanced Process Engineering Economics

Cost Evaluation: Capital and operating cost estimation, venture profitability, feasibility studies, and the effect of gearing, size and capacity factor on the DCF return. *Project Optimization:* Minimizing costs in the conception, design, tendering, construction, start-up and operational stages with emphasis on methods engineering, critical-path scheduling and good practice in business organization and management. *Australian Process Industry Economics:* The tariff, gross national product, balance of payments, productivity, population and industrial growth plus detailed economic analysis of Australia's chemical and metallurgical industries.

3.189G
Graduate Colloquia

Joint University/industry colloquia on research developments in Chemical Engineering. Students are required to participate actively in the colloquia, give at least one dissertation based on their own investigations, and complete a number of assignments on topics related to research skills. These last will cover such areas as statistical planning of experiments, modelling and the use of optimization techniques in the evaluation of experimental data.

3.190G
Specialist Lectures

3.191G
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.

Department of Food Technology

3.213G
Food Process Laboratory L0T3

An integrated series of laboratory and pilot plant exercises illustrating the principles and procedures involved in processing of foods.

3.241G
Food Technology L4T0

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.

3.242G
Treatment and Utilization of Biological Effluents L2T0

Parameters of water pollution, ecology of waste disposal. Treatment and use of water in food processing. Composition and treatment of sewage. Origin, composition, treatment, disposal and utilization of wastes from food and other biological industries. Legal and economic aspects. Plant and field inspections.

3.243G
Food Technology Seminar L0T2

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.

3.244G
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.

3.245G
Food Quality Assessment L1T0

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.

3.246G
Food Additives and Toxicology L1T0

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.

3.247G
Oenology L1T0

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.

3.248G
Public Health and Legislative Aspects of Foods L1T2

Sanitation in food processing, distribution and handling. Water supplies, utilization and disposal, insect and rodent control.Cleaning, disinfection, sanitation programs. Food poisoning and food-borne infections of chemical, plant, animal and microbiological origin. Food hygiene with particular reference to food service operations. Food Legislation. State and Codex standards and regulations, Pure Food Acts, Public Health Act.

3.249G
Technology of Cereal Products L1T0

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.

3.251G
Marine Products L1T0

World fisheries, oceánographic factors and fish populations. Biochemistry and microbiology of growth, culture, harvesting and post-harvest handling. Cultivation of fish molluscs, crustacea—modern and traditional methods. Biochemistry and microbiology of marine products in relation to freezing and preservation by the use of heat, chemicals and fermentation, quality control parameters and fish inspection. Role of marine products in world nutrition. Possibilities for further exploitation of marine resources.

Department of Fuel Technology

3.381
Principles of Fuel Engineering

An expanded version of the course 3.311 Fuel Engineering I, including appropriate laboratory work.

Textbooks are as for 3.311 Fuel Engineering I.

3.382
Combustion Engineering

Similar to 3.321 Fuel Engineering II. Offered in the graduate diploma.

Textbooks as for 3.321 Fuel Engineering II.

3.383
Fuel Plant: Evaluation and Assignments

Designed to meet the needs of individual students in the graduate diploma course, with an emphasis on the practical aspects of combustion engineering and the efficiency of operation of fuel plant. Also included are bridge courses of lectures in heat transfer, fluid mechanics, and chemical and engineering thermodynamics, which are designed to bring students from the varied backgrounds of their first degrees to a common level to facilitate further study of these subjects in the graduate diploma course.

Students are supplied with reading lists appropriate to individual requirements.

3.390G
Postgraduate Fuel Seminar

This is intended to assist students in assessing technical problems, in the collection of information and presentation of data, including technical report writing and critical evaluation of available information.

3.391G
Atmospheric Pollution and Control

Causes, measurement and control of atmospheric pollutants with special reference to fuel-using plant. Clean air legislation.

Textbooks

Stern A. C. Wohlers H. C. Boubel R. W. & Lowry W. P. *Fundamentals of Air Pollution* A.P.
Perkins H. C. *Air Pollution* McGraw-Hill

3.392G
Fuel Science

The nature of solid and liquid fuels, their physical and chemical properties and fundamental structure. The constitution of the coal matrix and coal petrography. The influence of the physical and chemical constitution of fuels and petrographic composition of coal on technological utilization.

Textbook

Krevelen D. W. van *Coal Typology, Chemistry, Physics and Constitution* Elsevier

3.393G
Fuel Engineering Plant Design

Extends the design subject-matter of 3.331.

Textbooks

As for 3.331

3.394G
Thermal Engineering and Fuel Processing

Extends the subject-matter of 3.331 and 3.332.

Textbooks

Inst. of Petroleum *Modern Petroleum Technology*
Holman J. P. *Heat Transfer* 3rd ed McGraw-Hill
McAdams W. *Heat Transmission* McGraw-Hill

3.395G
Research Techniques and Extension Methods

Designed to provide a critical approach to research activities. The topics are selected from the following:
1. Advanced analytical techniques (eg, spectroscopy, X-ray diffraction, chromatography, mass spectroscopy. NMR, other optical and instrumental methods. **2.** Mathematical methods in the design and interpretation of experiments, eg, formulation and solution of equations; statistical evaluation of results; empirical equations and nomographs; analogue simulation; an introduction to programming and use of digital computers.

Students to be supplied with reading lists appropriate to individual requirements.

3.396G
Unit Operations in Waste Management

The unit operations and processes associated with modern waste management practices, i.e. 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.

Textbook

1971 Waste Disposal Conference Dept of Fuel Technology Univ of NSW

Department of Biological Process Engineering

3.461G
Physical Transport Processes

Viscosity, thermal conductivity, diffusivity. Velocity, temperature, concentration distributions with more than one independent variable. Equations of change. Turbulent flow. Interphase transport in isothermal and non-isothermal systems. Multicomponent systems. Transient and oscillatory behaviour. Stability. General problem of transport in non-Newtonian fluids. Non ideal mixing—models and dynamics. Application to multiphase systems.

3.462G
Microbial Energetics

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.

3.463G
Theory of Rate Processes and Microbial Dynamics

Phenomenological characterization of reacting systems, mathematical and experimental characterization of complex kinetic systems. Kinetic behaviour of non-stationary state systems. Feedback mechanisms. Application to microbial systems. Control of metabolite and enzyme balance. Models of cell growth, eg, monod model; variable yield model; unstructured and structured models; feedback models.

3.464G
Theory and Design of Microbial Culture Processes

Basic theory of chemical engineering kinetics. Batch culture. Semi-batch culture. Basic theory of continuous culture. Multi-stage continuous culture. Application to continuous culture; **1.** research tool; **2.** industrial fermentations; **3.** effluent treatment; **4.** microbial oxidation of minerals. Biochemical unit operations. Special problems of design, materials and control introduced by aseptic requirements. Engineering problems associated with continuous biological processes.

3.471G
Chemical Engineering in Medicine

An introduction to general physiology, particularly emphasizing renal and respiratory physiology. The design and operation of artificial kidneys and membrane oxygenators. Application of chemical engineering principles to design of artificial organs. Criteria of optimal therapy. Objective functions for future development.

3.481G
Heat, Mass and Momentum Transfer

Revision of fluid dynamics, heat and mass transfer; boundary layer theory; applications to stagewise processes and two-phase flow, lift and drag coefficients, non-Newtonian flow. Unsteady state heat transfer by conduction, convection and radiation.

3.482G
Thermodynamics

Review of fundamental principles. First and Second Laws. Applications to biological systems, energy in important processes. Rates of reaction, activation, energy, free energy, and metabolism, activated complexes, redox potential and irreversible electrode potentials.

3.483G
Process Dynamics and Biochemical Engineering Design

Process dynamics and control: Principles of process dynamics and the mathematical technique employed. Dynamics of batch and flow processes with living organisms. Unstable systems.
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.

3.900G
Master of Applied Science Major Project

3.901G
Pollution Elective

School of Metallurgy

Undergraduate Study

4.001
Introduction to Materials Science 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.

Textbooks

Scientific American *Materials* Freeman
Gordon J. E. *The New Science of Strong Materials, or Why You Don't Fall through the Floor* Penguin

4.002
Introduction to Metallurgical Engineering 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.

Textbook

Street A. & Alexander W. O. *Metals in the Service of Man* Penguin

4.011
Metallurgy I L5T6

1. *General Introduction to Metallurgy.*

2. *Physical Metallurgy:* The crystalline structure and physical properties of solids. Structure sensitive and structure insensitive properties. Specific heat of solids. Phase equilibrium in alloy systems. Thermodynamical and physical aspects of binary systems. Mechanism of phase transformations. Departures from equilibrium and principles of heat treatment. Generation of microstructure. Metallography of iron-carbon and non-ferrous alloys.

3. *Chemical and Extraction Metallurgy:* Principles underlying the unit processes by which metals are extracted from ores and raw materials. The extraction metallurgy of iron and steel, copper, aluminium, lead, and zinc, together with the less common metals. An introduction to the principles of fluid flow, metallurgical stoichiometry, energy and mass balances, heat transfer.

4. *Mechanical Metallurgy:* Mechanical testing. The mechanical behaviour of solids, elastic and inelastic behaviour. The effects of stress state, temperature and strain rate. Creep, fatigue and brittle fracture. Metal shaping processes

Textbooks

Cottrell A. H. *An Introduction to Metallurgy* Arnold
Dennis W. H. *Extractive Metallurgy* Pitman
Geiger G. A. & Poirier D. R. *Transport Phenomena in Metallurgy* Addison-Wesley
Hume-Rothery W. & Raynor G. V. *The Structure of Metals and Alloys* The Institute of Metals, London
Reed-Hill R. E. *Physical Metallurgy Principles* Van Nostrand

4.012
Metallurgy II S1 L9T10 S2 L8T11

1. *Metallurgical Thermodynamics:* An introduction to the thermodynamics of metallurgical systems including a study of equilibria involving liquid metals, slags, gases and the solid state.

2. *Chemical and Extraction Metallurgy:* The application of physicochemical principles to the study of metallurgical processes. Electrochemistry and the related topics of corrosion and hydrometallurgy. The engineering basis of extraction metallurgy; heat and mass transfer, high temperature technology.

3. *Physical Metallurgy:* Theories of diffusion, phase equilibrium and transformation, and their application to alloying, heat treatment, and other metallurgical processes.

4. *Mechanical Metallurgy:* Analysis and effects of complex stress states in relation to flow and fracture. Stress concentration. Residual stresses. Creep, fatigue and brittle fracture, metallurgical and engineering aspects.

5. *Mineral Processing:* The principles and practices associated with liberation, beneficiation, froth flotation, hydrometallurgy, materials handling and process engineering.

6. *Theory of Plastic Deformation:* Geometry of slip in metal crystals. Polycrystalline materials; preferred orientation. Introduction to dislocation theory; application of this theory to yielding, strain ageing, work- and solution-hardening.

7. *X-ray Diffraction and Theory of the Metallic State:* X-ray diffraction and its application to metallurgy. Development of the modern theory of solids based on the zone theory.

8. *Special Topics:* Further development of topics from the above sections.

Textbooks

As for 4.011 Metallurgy I, plus:

Barrett C. S. & Massalski T. B. *Structure of Metals* 3rd ed McGraw-Hill
Bodsworth C. & Appleton A. S. *Problems in Applied Thermodynamics* Longman
Cottrell A. H. *The Mechanical Properties of Matter* W.I.E.
Darken L. S. & Gurry R. W. *Physical Chemistry of Metals* McGraw-Hill
Hull D. *Introduction to Dislocations* Pergamon
Mann J. Y. *Fatigue of Materials* MUP
Swalin R. A. *Thermodynamics of Solids* 2nd ed Wiley Interscience
West J. M. *Electrodeposition and Corrosion Processes* Van Nostrand

For the Mineral Processing section see under 7.023 (Part 2) Mining and Mineral Process Engineering (School of Mining Engineering).

4.0121
Metallurgy IIA — S1 L5T4 S2 L5T6

Comprises sections **1.**, **2.** (part only), **3.** and **5.** of 4.012 Metallurgy II, together with appropriate laboratory work.

4.0122
Metallurgy IIB — S1 L4T6½ S2 L5T6

Comprises section **2.** (part only), **4.**, **6.**, and **7.** of 4.012 Metallurgy II, together with:

9. *Industrial Metallurgy:* A course of lectures on the application of metallurgical principles to industrial practice.

10. *Metallurgy Seminar:* As specified in 4.013 Metallurgy III.

The section on "Mineral Processing" in 4.012 and 4.0121 is given by the School of Mining Engineering in 7.023 (Part **2.**). For Textbooks see under 7.023.

Textbooks

For 4.0121 and 4.0122.
As for 4.012 Metallurgy II.

4.0123
Metallurgy IIC — L2T2

Principally industrial metallurgy, and substantially as for section **9.** in 4.0122.

4.0124
Metallurgy Report

A literature survey of approximately 10,000 words on a topic of relevance to the student's employment. The proposed topic must be submitted to the Head of School for approval before the end of the third week of Session 1 and the report submitted not later than the end of the seventh week of Session 2.

4.013
Metallurgy III — S1 L8T10 S2 L4T6

1. Development and application of metallurgical principles relating to the thermodynamics and kinetics of metallurgical processes; structural chemistry; the extraction and refining of the rarer metals; crystal imperfections, with reference to deformation, work hardening, annealing and fections, with reference to deformation, work hardening, annealing and radiation damage; X-ray and neutron diffraction; phase transformations; fracture mechanisms; and the design of engineering materials.

2. The application of metallurgical principles to industrial practice, with particular reference to welding, foundry practice, metal shaping, metal finishing, materials selection and non-destructive testing.

3. Seminar.

Textbooks

As for 4.011 Metallurgy I and 4.012 Metallurgy II.

4.024
Metallurgy Project

An experimental investigation of some aspects of metallurgy.

4.121
Principles of Metal Extraction — L2T1

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

Textbooks

Pehlke R. D. *Unit Processes of Extractive Metallurgy* Elsevier
Rosenquist T. *Principles of Extractive Metallurgy* McGraw-Hill

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* — S1 L1T4 S2 L1T1

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* — S1 L4T3 S2 L2T0

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.

4.314
Chemical and Extraction Metallurgy IIIA* — L3T1½

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.

* Textbooks provided by the School.

4.324
Chemical and Extraction Metallurgy IIIB* L3T1½

A selection of advanced topics in chemical and extractive metallurgy.

4.402
Physical Metallurgy I* S1 L3T4 S2 L2T4½

The crystal structure of metallic phases. Crystal defects. Physical properties of solids. X-ray diffraction. Phase equilibrium in alloy systems. The genesis of microstructure. Mechanism of phase transformations, departures from equilibrium. Heat treatment of alloys.

4.403
Physical Metallurgy II* S1 L4T6 S2 L2T3

Diffusion in metals. Nucleation of solid phase transformations. Precipitation hardening. 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.

4.414
Physical Metallurgy IIIA* L3T1½

Applications of dislocation theory to work hardening and annealing processes. Transformations in metals. Mathematical crystallography, reciprocal lattice, diffraction.

4.424
Physical Metallurgy IIIB* S1 L0T3 S2 L3T1½

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

4.504
Mechanical and Industrial Metallurgy* S1 L3T0 S2 L3T6

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.

4.602
Metallurgical Engineering I* S1 L2T0 S2 L3T3½

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.
Mechanical metallurgy. Analysis of stress and strain. Stress-strain relationships in solids. Mechanical testing. Mechanical behaviour of metals. Effects of stress state, temperature and strain rate. Creep, fatigue and brittle fracture. Principles of metal shaping processes.

4.604
Metallurgical Engineering III* S1 L3T3 S2 L6T3

Theory of automatic process control. Process modelling and optimization. Process design, feasibility, costing and economics applied to metal extraction, refining, fabrication and finishing. Industrial practice. Case studies, design studies and assignments related to the design of integrated metallurgical process schemes.

4.613
Metallurgical Engineering IIA* S1 L1T0 S2 L1T2

The principles of metallurgical heating and cooling including fuels, refractories and furnace design and operation. Solidification in moulds, continuous casting. Flow and fracture of materials. Fractography. Theory of fracture. Flow of metals in metal working. Defects and their significance. Experimental stress analysis.

4.623
Metallurgical Engineering IIB* L3T3

Measurement in metallurgical processes. Continuous process theory. Materials handling. Metallurgical engineering design applied to mechanical, pyrometallurgical and hydrometallurgical extraction and refining processes, and to melting, casting and shaping processes. Design project.

4.703
Materials Science* L3T3

Extension of the structure—property relationships developed in earlier subjects to provide a unified physical, chemical and mechanical approach to the properties of materials.

4.802
Metallurgical Physics* L2T0

Development of physical principles for application in metallurgy—wave mechanics; electron theory; statistical mechanics; interaction of radiation with matter; solid state devices, instrumentation.

4.813
Mathematical Methods L2T1

1. *10.351 Statistics SM* (see Combined Sciences 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.

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.

Textbook

Barrett C. R. Nix W. D. and Tetleman A. S. *The Principles of Engineering Materials* Prentice-Hall

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.

* Textbooks provided by the School.

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.

Textbook

Clark D. S. and Varney W. R. *Physical Metallurgy for Engineers* Van Nostrand

4.921
Materials Science — L1T0

(For students in Electrical Engineering.) This subject forms part of 8.111 Civil Engineering.
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, semi-conductors and insulators. Magnetic materials—structure and properties.

Textbook

As for 4.911 Materials Science.

4.931
Metallurgy — L1½T½

For students of Civil Engineering. Part of 8.272 Civil Engineering Materials I.

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.

Textbook

As for 4.911 Materials Science

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 mechanisms, brittle fracture, fatigue and creep. Corrosion and oxidation of metals. Specification and selection of engineering alloys.

Textbook

As for 4.911 Materials Science

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.

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.

School of Mechanical and Industrial Engineering

Undergraduate Study

5.010
Engineering A — SS L4T2

Prerequisite: None.

Engineering Mechanics 1: Two and three dimensional force systems, composition and resolution of forces, laws of equilibrium. Statics of rigid bars, pin-jointed frames. Shear force, axial force, bending moment. Simple states of stress. Kinematics of the plane motion of a particle. Kinetics of the plane motion of a particle; equations of motion, dynamic equilibrium, work and energy.

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 description and textbooks see under 4.001.

Textbooks

Meriam J. L. *Statics* Wiley
Svensson N. L. *Introduction to Engineering Design* NSWUP
Walshaw A. C. *S1 Units in Worked Examples* Longman
and
For *Introduction to Materials Science:*
Gordon J. E. *The New Science of Strong Materials or Why You Don't Fall through the Floor* Pelican
Scientific American Materials Freeman

5.020
Engineering B — SS L4T2

Prerequisite: 5.010.

Engineering Mechanics II: Further development of Mechanics I together with: Virtual work. Cables and catenaries. Geometric properties of plane figures. Kinetics of systems of particles; impulse and momentum. Rotation of a rigid body about a fixed axis.

Textbooks

Meriam J. L. *Statics* Wiley
Meriam J. L. *Dynamics* Wiley
This book required by students enrolling in 5.311

5.030
Engineering C

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

and either

Introduction to Systems and Computers: Introduction to computers to follow the computer work in Mathematics I. Develops familiarity with algorithms and the use of procedure-oriented languages, and introduces computing equipment.

Systems. Introduction and Concepts: Some of the concepts used in engineering, the relationship of these concepts to phenomena within students' experience, and the illustration of the concepts by case histories and engineering examples. Quantities. Concepts. Components. Systems.

or

Introduction to Chemical Engineering (Compulsory for Chemical Engineering students): Routes to and end uses of industrial chemicals. Likely new industrial chemicals. A survey of several Australian chemical industries for the point of view of their historical and economic importance. Examination of the unit operations involved in the industry and the raw materials, equipment and services used. Environmental aspects of the chemical industry.

or

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

or

(Mining Engineering students must take this option)
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.

or

Introduction to Computing: Introduction to computer program design with emphasis on correctness and reliability.

Textbooks

For *Engineering Drawing:*
Robertson R. G. Descriptive Geometry Pitman.
Thomson R. *Exercises in Graphic Communication* Nelson
For *Introduction to Systems and Computers:*
Karbowiak A. F. & Huey R. M. eds. *Information, Computers, Machines and Man* Wiley
For *Introduction to Metallurgical Engineering:*
Street A. & Alexander W. O. *Metals in the Service of Man* Penguin
For *Mechanics of Solids I:*
Hall A. S. *Introduction to the Mechanics of Solids* Prentice-Hall
For *Introduction to Computing:*
Wirth N. *Systematic Programming: An Introduction* Prentice-Hall

5.111
Mechanical Engineering Design I

Prerequisites: 5.010, 5.020. Co- or prerequisite: 5.311, 5.611, 8.151, 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.

Textbook

DeGarmo E. P. *Materials and Processes in Manufacturing* Macmillan

5.311
Engineering Mechanics — SS L1½T1

Prerequisites: 1.001, 5.010, 5.020. Co- or prerequisite: 10.001.

Kinematics and kinetics of the plane motion of rigid bodies. Absolute motion, relative translational motion and relative angular motion; dynamic equilibrium; work and energy; impulse and momentum.

Textbook

Meriam J. L. *Dynamics* Wiley

5.331
Dynamics of Machines I — S1 + S2 L1½T½

Prerequisites: 5.311, 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. Laplace transform methods and transfer functions.

Textbook

Hirschhorn J. *Dynamics of Machinery* Nelson

5.611
Fluid Mechanics/ Thermodynamics I — S1 + S2 L2T2

Prerequisites: 1.001, 5.010, 6.020, 10.001. Co- or prerequisites: 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. Turbomachines. 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.

Textbooks

Massey B. S. *Mechanics of Fluids* Van Nostrand
Wark K. *Thermodynamics* 2nd ed McGraw-Hill *or*
Lee J. F. & Sears F. W. *Thermodynamics* 2nd ed Addison-Wesley
Reynolds W. *Thermodynamics* 2nd ed McGraw-Hill

School of Electrical Engineering

Undergraduate Study

6.801
Electrical Engineering — S1 + S2 L1T2

Prerequisite: 1.001.

The application of electrical engineering to other disciplines such as mechanical and civil engineering, industrial chemistry and geophysics. The only basic electrical theory considered is that necessary for an understanding of the applications. The course is divided into two sections, each of which contains an inter-disciplinary applications-oriented project.

SESSION 1: Principles of circuit theory and analog computing. Amplifiers, their specification and application. Transducers. Electronic instrumentation. Industrial data acquisition.

Textbook

Smith R. J. *Circuits Devices and Systems* 2nd ed Wiley

SESSION 2: Principle of circuit theory. Transformers Electrical machines, their selection, control and application in industrial environments. Elements of the utilization and distribution of electrical power.

Textbook

Smith R. J. *Circuits Devices and Systems* 2nd ed Wiley

School of Mining Engineering

Undergraduate Study

7.012 and 7.012R
Mineral Resources

Part 1. Historical & economic introduction, definitions. Geological time scale. Principles of mining. Unions, industrial tactics. Salient data on the mineral industry, fuels, metals, industrial minerals. Mining law, government assistance and controls. Tutorial exercises.

Part 2. Safety engineering in relation to shafts, winches, rises, stopes, drives, tunnels. Integration of safety with production, operations. Electric shock, safety in respect to boilers, diesel engines, electrical equipment, earthing and storage of fuels. Introduction to ore reserves, company structure. Tutorial exercises in mining methods.

Textbooks

Warren K. *Mineral Resources* Pelican
Com of Aust *The Australian Mineral Industry Annual Review* Bur of Min Res
Thomas L. J. *An Introduction to Mining* Hicks Smith

7.023 and 7.023R
Mining and Mineral Process Engineering

1. Mining Engineering: a technical introduction to mining engineering. Prospecting. Types of mineral deposits. Classification of mining methods, applications to coal, non-metallic and metalliferous deposits, petroleum production engineering and sea floor mining. Tutorial exercises, demonstrations and laboratory work.

2. Mineral Process Engineering: a technical introduction to mineral process engineering. Liberation. Theories of comminution, crushing and grinding. Particle size analysis, screening and classification. Principles of methods of concentration including froth flotation. Product disposal. Flowsheets, materials balance calculations. Sampling. Tutorial exercises, demonstrations and laboratory work.

Textbooks

Gaudin A. M. *Principles of Mineral Dressing* McGraw-Hill
Lewis R. S. & Clark G. B. *Elements of Mining* Wiley
Thomas L. J. *An Introduction to Mining* Hicks Smith

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. Quantitative analysis by microscope; chemical; use of heavy liquids; or magnetic and conductive processes.

Textbook

Jones M. P. & Fleming M. G. *Identification of Mineral Grains* Elsevier

7.113 and 7.113R
Mining Engineering I

Two parts will be taught in each session.

Part 1. Development patterns and techniques for mineral deposits. Explosives, their classification, characteristics and properties. Ammonium nitrate based explosives. Blasting fundamentals, rock fragmentation. Drilling equipment and techniques. Deep boring. Shaft sinking, preliminary considerations, planning layout and equipment, methods. Tunnelling, planning, lay-out, excavation methods and equipment. Underground power stations and storages.

Part 2. Advanced mining systems and excavation equipment, elements of mine design as influenced by the system. Orebody types and classification, factors in the selection of mining method. Surface methods, metallic and non-metallic, open cuts, dredging, strip mining. Underground coal mining, horizon, bord and pillar, longwall. Underground metal mining, open stoping, supported stoping, caving. Composite mining methods, pillar recovery. Parameters for applicability and efficiency of mining methods. Mining waste disposal and utilization.

Part 3. Non entry mining methods. 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 engineering, 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.

Part 4. Mechanical properties of rocks and soils. Failure theories. Analysis of existing structures and openings. Criteria for prediction of failure. Post failure analysis. Structures under compression. Natural state of stress in rock masses. Stress concentration around underground openings. Support requirements and design.

Textbooks

Calhoun J. C. *Fundamentals of Reservoir Engineering* Oklahoma UP
Lewis R. S. & Clark G. B. *Elements of Mining* Wiley *or*
Pfleider E. P. & Eugen D. *Surface Mining* AIME
Sinclair J. *Winning Coal* Pitman.
Woodruff S. D. *Methods of Working Coal and Metal Mines* 3 vols Pergamon

7.124
Mining Engineering II

1. Mine atmospheres, gases, dust. Spontaneous combustion, fires, rescue, recovery. Mine ventilation, flow of air in mines, friction factors, shock losses. Psychometry. Mine fans, booster and auxiliary, fan laws, introductory thermodynamics. Natural ventilation.

2. Bulk materials handling underground, hoisting, conveyors, tracked and trackless transport, wire ropes, oil and slurry pipe lines. Mine drainage pumps, pump stations, flooding and dewatering. Noise control in mines.

3. Requirements of Mines Inspection Acts with respect to electrical power distribution, power supply and transmission. Mine safety, health, metallic poisons, hygiene, diseases, forensic investigations. Mine lighting. Compressed air generation and reticulation.

7.124R
Mining Engineering II

For students in BSc(Eng) based on topics principally selected from the syllabi of 7.124, 7.224 and 7.234. Some topics from 7.134 and 7.144 may also be included or recommended for additional reading.

7.134
Mining Engineering III

Review of rock fragmentation and rapid excavation techniques, nuclear blasting applied to mining and oil reservoirs. Advanced composite mining techniques for coal and metalliferous deposits with particular reference to mechanization, computer applications to mining methods and transport.

7.144
Mining Engineering IV

Advanced mine ventilation, network analysis, mine thermodynamics. Mine climate, air contaminants and noxious gases, comfort, air cooling power, heat stress, problems in hot, deep mines. Air conditioning in mines. Design of open pit excavations and underground structures in rock. Mechanics of mining subsidence. Exercises in mine design and layout. Computer applications to ventilation and mine design.

Textbook

Jaeger J. C. & Cook N. G. W. *Fundamentals of Rock Mechanics* Methuen.

7.213
Mine Surveying and Control Engineering

Surveying methods in the development and exploitation of mineral resources and the assessment of mineral properties. Tunnel surveys, azimuth transfers, borehole surveys, stope and ore reserve surveys. Mine survey office organization. Production and development scheduling, use of networks, integrated networks, resource restrained networks. Production control, grade control. Demonstrations of equipment.

7.213R
Mine Surveying and Control Engineering

For students in the BSc(Eng) course; based on the syllabus of 7.213.

Textbooks for 7.213 and 7.213R

Staley W. W. *Introduction to Mine Surveying* 2nd ed Stanford UP
or
Winiberg F. *Metalliferous Mine Surveying* 5th ed Min Pub Ltd
or
Metcalfe J. E. *A Mining Engineer's Survey Manual* Electrical Press

7.224
Mine Valuation

Sampling Theory applied to projection of boreholes, ore bodies and milling. Valuation of mineral properties. Resource allocation, finance, labour, equipment. Infrastructure and taxation. Size and scope of mining company operations.

Textbook

Baxter C. H. & Parks R. D. *Examination and Valuation of a Mineral Property* Addison-Wesley.

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.

Textbook

C'wealth of Aust *The Australian Mineral Industry Review* Annual and Quarterly Bureau of Min Res

7.314
Mineral Processing I

Applied mineralogy, assessment of physical and chemical properties, liberation. Theory of particle breakage, comminution, crushing and grinding, particle size distribution and analysis. Gravity and other physical methods of separation. Froth flotation. Chemical extraction. In situ recovery processes. Coal preparation. Fluid mechanics of mineral pulps, free, hindered and zone settling, thickening, classification, dewatering. Materials handling. Process design.

7.314R
Mineral Processing I

For students in the BSc(Tech) course. Based on the syllabus of 7.314.

7.315R
Mineral Processing for Mining Engineers

An abridged course for students in the BSc(Eng) course based on the syllabus of 7.314.

Book List for 7.314, 7.314R and 7.315R.

Textbook

Taggart A. F. *Handbook of Mineral Dressing* Wiley

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.

Textbook

Taggart A. F. *Handbook of Mineral Dressing* Wiley

7.324
Mineral Processing II

Surface chemistry, adsorption, electrical double layers, stabilization and dispersion of mineral particles. Flocculation and froth flotation.

Textbook

Gaudin A. M. *Flotation* 2nd ed McGraw-Hill

7.326R
Mineral Industry Processes

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

Text and Principal Reference Books

Students should obtain list from Broken Hill.

7.334
Mineral Processing III

Integration of mineral processing techniques with mechanical, chemical and metallurgical operations. Process engineering. Laboratory and pilot plant testing, project evaluation. Preparation of flowsheets, equipment selection and plant design.

Textbooks

Denver Equip. Co *Modern Mineral Processing Flowsheets*
Leonard J. W & Mitchell D. R. *Coal Preparation* AIME

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.

Textbooks

Students should obtain book list, including principal reference books, from Broken Hill.

7.414
Mineral Industry Elective Project

The elective project may be selected from one of the following options, and consists of a literature survey and a thesis. An assignment is also set on the lectures and tutorials.

1. *Mathematical Models for Mining Methods:* Presenting a rapid technique for the examination and analysis of mining methods, indicating modifications to a basic mining system which makes for better adaptation to a particular ore body. Computer control of production and rapid re-assessment of the ore production capacity of a mine in relation to quantity and grade control.

2. *Advanced Mine Design:* Review of mining methods. Transport considerations. Level interval determinants. Location of mine shafts. Design of shaft systems. Factors influencing stope design. Services openings. Computer applications in design. Design for emergency conditions. Mine design exercises.

3. *Explosives Engineering:* Characteristics of high explosive, classification of explosive compounds and mixtures; ammonium nitrate based explosive mixtures. Theories of detonation; rock fragmentation, theories of blasting, calculation of charge, bench blasting, short delay blasting, smoothwall blasting, submarine blasting. Ground vibration.

4. *Mechanics of Bulk Materials Handling:* Appraisal of available methods. Belt conveyors, chain conveyors, bucket elevators, screw conveyors and elevators, shaking and vibratory conveyors, fluid transport, rope haulage, monorails, aerial ropeways, locomotive haulage. Mine hoisting systems.

5. *Dredging:* Beach sand and alluvial deposits. Origin of deposits. Sampling techniques and evaluation. Equipment, mining systems, tailing disposal, surface restoration.

6. *Natural Gas Technology:* Properties of natural gas and reservoir fluids. Single and two phase flow in wells. Theory and practice of gas reservoir engineering. Distribution of natural gas. Conservation and storage of natural gas.

7. *Mine Organization and Methods:* Mine organization charts, mine operation and cost control. Human relations in mining. Detailed production and development scheduling and networks. Modern mining methods: Mechanized cut and fill, sub-level caving, block caving, sub-level open stoping. Open cut, strip mining, longwall. Quantitative analysis of conservation of resources and environment.

8. *Mine Filling:* Support and mining roles of fill. Fill emplacement, cost analyses, mining methods employing fill. Hydraulic fill: compressibility, permeability, size grading effects. Cemented fill: properties, production, specialist application and requirements. Rock fill and cemented rock fill. Attrition in passes, rill classifications, placement of mixed fills.

9. *Advanced Rock Mechanics:* Methods of stress and strain analysis. Theories of rock failure. Photo-elasticity. Finite element methods. Laboratory use of strain measuring equipment. Rock stress determination techniques. Deformation measuring equipment. Elements of elastic wave theory. Theories of blasting. Theory of shock propagation. Calculation of explosive pressure. Rock bursts. Hydraulic fracturing. Workability of coal and other minerals. Design of tailing dams. Recent developments in rock mechanics.

10. *Computer Methods:* Advanced use of Fortran IV. Linear programming. Monte-Carlo method. Simulation techniques. Ore reserves calculations. Critical path analysis. Transport system analysis. Use of computers in surveying. Geological data processing. Mining system analysis. Open pit design. Production planning.

11. *Comminution:* Comminution and Sizing: rock properties, methods of fracture and breakage, size distribution and size control, sampling granular materials.

12. *Flotation:* Flotation theory: sulphide minerals, oxidized and oxide minerals, salt minerals, calcium minerals.

13. *Coal Preparation:* Coal constitution, bore core evaluation, non-destructive testing, interpretation of analyses for selective preparation, blending for utilization.

14. *Mineralogical Assessment for Leaching:* Analysis of Physical and chemical properties of mineral assemblages for process design, selection of solvents, methods of dissolution, solvent extraction, precipitation, cementation, refining.

15. *Flowsheet Planning:* Assessment of mineral properties; extraction processes and environmental conditions for the basis of process design. Selection of technology to be adopted; assemblage, selection and location of equipment. Fluid-solids flows; design of auxiliary units. Development and presentation of flowsheets and material balances.

16. *Advanced Mine Ventilation:* The energy equation applied to mine ventilation, sources of heat in mines, geothermal gradients, mine thermodynamics, pressure volume diagrams. Fan design, installation and testing. Psychrometry, air conditioning, ventilation planning, surveys and network analysis. Computer applications.

7.414R
Mineral Industry Elective Project

For students in the BSc(Eng) and BSc(Tech) courses, based on the syllabus for 7.414: Literature survey and thesis.

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. Deflection and deviation in diamond drilling: drill hole surveys. Development and exploitation of mineral resources; shaft sinking, tunnelling, excavation methods.

7.111G
Mining Engineering

1. Surveying methods in the development and exploitation of mineral resources. Mine development, drilling equipment and techniques. Explosives, their characteristics and properties. 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. Introductory rock mechanics, mechanical behaviour of rocks. The Mining Acts.

7.122G
Mining Engineering Technology

1. Mine ventilation, mine atmospheres, quality and properties of mine air, contaminants, toxicity of mineral particles and gases, thermodynamics of mine air, network analyses, air conditioning in mines. Mine safety, health, mine hygiene, noise control.

2. Mine lighting, electrical power distribution, generation and reticulation of compressed air. Materials handling, fundamental concepts. Surface and underground haulage systems, design of conveyors and locomotives, mine hoisting, design criteria. Mine drainage.

3. Feasibility studies. Mine design and layout, separation of functions for maximum efficiency; application of analogue and digital computers. Production control, grade control. Mine valuation, administration. Sampling. Valuation of mineral properties. Resources allocation, finance, labour, equipment. Size and scope of mining company operations.

4. Mine support. Mining methods employing fill. Hydraulic fill, compressibility. Rock fill and cemented rock fill. Placement of mixed fills.

5. Rock mechanics. Stress and strain analysis. Theories of failure. The mechanics of strata movement and the distribution of presure 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 exercises in sampling and valuation, mine support, temporary or long term; mine design and plant related to extraction areas 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. Stress distribution around underground excavations. Effects of geological structures on the stability of mine working. Stresses and rock movements induced by mining operations. Design of underground excavations in competent and incompetent rock. Design of mining systems and layout of workings based upon rock mechanics and functional considerations.

2. Principles and design of natural and artificial support systems. Interrelation of temporary, stabilizing and long term support. Support of permanent mining and civil engineering openings. Support at the face and in the waste. Control of ground in the vicinity of production excavations; mine filling, its source, characteristics and application.

3. Design and construction aspects of open pit slopes and tailing dams.

4. Rock-breaking and drilling method; penetrability and workability of rocks. Hydraulic fracturing. Nature, occurrence and prediction of rockbursts. Mechanics of mining 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 prior to mining, 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, air conditioning, ventilation planning, surveys, and network analysis. Computer applications. Selected laboratory experiments and network designs.

7.154G
Rock Excavation and Transportation

Methods of rock fragmentation drilling, explosives, 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. Selection procedures, cost analysis.

7.311G
Mineral Beneficiation

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

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, assessment of mineral properties, 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. Management.

7.332G
Mineral Engineering Laboratory

Laboratory investigations may be selected from the following classifications according to availability and specialization: metalliferous ore concentration; coal preparation; beneficiation of non-metallics; processing of mineral fluids.

7.351G
Mineral Benefication

Process design based upon assessment of mineral properties; extraction processes and environmental conditions. Selection of technology to be adopted. Basis of feasibility studies. Special considerations for coal preparation and treatment of industrial minerals. Flowsheet planning, solid and fluid flows, auxiliary units, materials handling, product disposal. Experimental techniques used in testing.. Scale up procedures. Plant control, automation, use of computers. Management of mineral processing operations.

7.442G
Mineral Industry Analysis

This subject involves advanced work in the technical and economic analysis of mining and mineral processing operations carried out on mine leases. Cases are selected for examination and analysis, and a critical review must be written of the operations analysed.

Textbooks

For all Mining and Mineral Engineering Graduate Subjects.

Arbiter N. *Milling Methods in the Americas* Gordon & Breach Sci. Pub.
Baxter C. H. & Parks R. D. *Examination and Valuation of a Mineral Property* Addison-Wesley
Cameron E. N. *Ore Microscopy* Wiley
Commonwealth of Australia *The Australian Mineral Industry Review. Annual and Quarterly* Bureau of Min. Res.
Jaeger J. C. & Cook N. G. W. *Fundamentals of Rock Mechanics* Methuen
Lewis R. S & Clark G. B. *Elements of Mining* Wiley
Obert L. & Duvall W. I. *Rock Mechanics and the Design of Structures in Rocks* Wiley
Peele R. *Mining Engineers Handbook* 3rd ed Vols I & II Wiley
Pfleider E. P. & Eugen D. *Surface Mining* A.I.M.E.
Rose H. E. & Sullivan R. M. *Ball Tube and Rod Mills* Constable
Taggart A. F. *Handbook of Mineral Dressing* Wiley
Woodruff S. D. *Methods of Working Coal and Metal Mines* 3 vols Pergamon

8.171
Mechanics of Solids I

This subject forms part of 5.020 Engineering B and 5.030 Engineering C.

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.

Textbook

Hall A. S. *Introduction to the Mechanics of Solids* SI ed Wiley

8.172
Mechanics of Solids II SS L2T2

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.

Textbook

Hall A. S. *Introduction to the Mechanics of Solids* SI ed Wiley

8.250
Properties of Materials

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.

Textbook

Polakowski N. H. & Ripling E. J. *Strength and Structure of Engineering Materials* Prentice-Hall

8.259
Properties of Materials S1 + S2 L1T2

8.250—Properties of Materials, *plus* the structure and properties of binary alloys; control of structure and properties, commercial alloys, materials selection.

School of Civil Engineering

Undergraduate Study

8.112
Materials and Structures S1 + S2 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.

Properties of Materials: Mechanical behaviour of materials; response to static and dynamic loads. Laboratory techniques. Analysis and presentation of experimental results. Use of material properties in analysis and design.

Graduate Study

8.708G
Finite Element Methods in Civil Engineering I

The concept of finite elements. Energy principles. Finite elements of displacement type. Computer techniques for finite elements.

8.753G
Soil Mechanics I

Soil pedology, fabric studies, unsaturated soils, transient water flow in soils.

8.901G
Civil Engineering Elective I

A Session 1 occasional elective on a civil engineering topic, selected according to current demand and availability of local and visiting specialists.

School of Wool and Pastoral Sciences

Undergraduate Study

9.121
Livestock Production I — L2T1

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 management; nutrition, reproduction, survival.

Textbooks

Alexander G. & Williams O. B. *The Pastoral Industries of Australia* Sydney U.P.
James B. J. F. ed *Animal Reproduction* Cheshire.

9.122
Livestock Production II — L2

Statistics on beef production, home consumption and export markets. Breeds of beef cattle, cross breeding and dairy-beef production.

Selection of breeding stock, factors affecting reproduction and performance recording. The effect of climate on beef cattle performance, applied and physiological aspects.

Carcass appraisal, methods of grading and quality aspects of meat. Artificial breeding and feedlotting of beef cattle. Management practices.

Textbooks

Alexander G. & Williams O. B. *The Pastoral Industries of Australia* Sydney U.P.
Cole V. G. *Beef Cattle (Production) Guide* Grazcos

9.123
Livestock Production III — L2

The dairying and pig industries of Australia; patterns and trends. Principal breeds and their uses. Production of milk and milk by-products, and of pigmeats. Quality concepts of the various products.

Management of the dairy cow; selection and management of the dairy sire.

Selection of breeding pigs. Pig housing, management and feeding. Wastage and disease.

Textbooks

Downey L. A. *Pig Raising* 2nd ed A. & R.
Lamond D. R. & Campbell, A. *Dairy Cattle Husbandry* 2nd ed A. & R.

9.124
Livestock Production IV — L1T1

Principles of livestock production and their application in optimizing animal production; reproduction and fertility; growth and development. The meat industry; slaughter, meat inspection and preservation; utilization of by-products. Carcass conformation and composition and measurement techniques for predicting same. Meat quality.

Textbooks

James B. J. F. ed *Animal Reproduction* Cheshire
Sadleir R. M. *Ecology of Reproduction in Domestic Animals* Methuen
Tribe D. E. ed *Carcass Composition and Appraisal of Meat Animals* CSIRO

9.131
Animal Health and Preventive Medicine I — L2T1

Causes of disease. Symptomatology and recognition of the abnormal state; Nutritional conditions and digestive disorders; Deficiencies; excesses, diseases initiated by starvation. Avitaminosis, sheath rot. Diseases causing intestinal dysfunction including effect of parasites on production. Diseases of the feet and bone structures. Diseases causing locomotive dysfunction and abnormal behaviour. Diseases affecting the wool and skin, including external parasites. Management and disease, including conditions initiated by injury, shearing, dipping, lamb marking, lambing. Plant and mineral poisoning. Economics of disease and production. Jurisprudence.

9.132
Animal Health and Preventive Medicine II — L2T1

Immunology and vaccination. Diseases causing sudden death or an acute state of disease. Diseases of the eye. Diseases of the mouth and nose, cattle and sheep. Diseases of the udder. Diseases of the reproductive organs and of new born lambs. Kidney dysfunction and urinary calculi. Diseases of the lungs. Diseases causing anaemia. Other diseases of economic importance. Internal parasites: life cycles and climatic factors, major parasites, abomasum, small intestine, large intestine, lungs, liver. Development of control programs. Management and parasites (parasites on pasture). Treatment and control. Parasite identification. Cattle diseases.

9.221
Agronomy — L2T2

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.

9.231
Pastoral Agronomy — L1½T1½

Pasture ecology. Establishment, management and utilization of pastures and fodder crops. Vegetation management in arid and semi-arid areas. Pasture research techniques.

Textbooks for 9.221 and 9.231

Barnard C. *Grasses and Grassland* Macmillan
Black J. M. *Flora of South Australia* (Parts I-IV) S Aust Govt Printer
Burbidge N. T. *Australian Grasses* Vols. I, II & III A & R
CSIRO *The Australian Environment* MUP
Donahue R. L. *Soils* Prentice-Hall
Leeper C. W. *Introduction to Soil Science* MUP
Molnar I. ed *Manual of Australian Agriculture* 2nd ed Heinemann
Spedding C. R. *Grassland Ecology* OUP
Whittet J. N. *Weeds* NSW Dept of Agriculture
Wilson B. *Pasture Improvement in Australia* Murray

9.232
Crop Agronomy — L2

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

9.311
Agricultural Economics I — L2

The nature and development of agricultural economics and farm management. Theory and practical applications of production economics principles and the analysis of production functions.

Theory, construction and analysis of cost curves. Economies of size and the problem of optimum farm size.

Introduction to price theory. The nature and derivation of supply and demand relationships, and of factors which affect these relationships. Illustration of the role of price theory in the analysis of agricultural policies. Problems in the empirical estimation of supply and demand.

Textbooks

Bishop C. E. & Toussaint, W. D. *Introduction to Agricultural Economic Analysis* Wiley
Heady E. O. *Economics of Agricultural Production and Resource Use* Prentice-Hall
Samuelson P. A. Hancock K. & Wallace R. *Economics: Australian Edition.* McGraw-Hill

9.312
Agricultural Economics II — L2

The structure and functions of agricultural marketing systems and institutions. Use of price theory in the examination of problems and policies affecting marketing systems. Effects on agricultural markets of subsidies, taxation, population growth and economic development.

Introduction to the theory of international trade and international monetary mechanisms. Interrelationships between trade policies and agricultural policies.

Review of current issues in agricultural policy: the small farm problem and declining industries; rural credit policies.

Textbooks as for 9.311, plus:

Williams D. B. ed *Agriculture in the Australian Economy* Sydney UP

9.313
Farm Management I — L2

Farm management planning methods: gross margins analysis; simplified programming; partial budgeting; parametric budgeting; whole-farm budgeting; development budgeting and cash flow budgeting. Discounting methods, taxation provisions and rural credit facilities affecting evaluation of rural investments.

Principles and practice of methods of valuation of rural assets. Land tenure and systems of title.

Financial and production records and accounts. Co-ordination of managerial accounts with taxation requirements. Current developments in managerial accounting for rural industries. Use of farm records as indicators of economic efficiency and as sources of information for normal farm planning methods.

Textbooks

Castle E. N. & Becker M. H. *Farm Business Management* Macmillan NY
Joint Committee on Standardisation of Farm Management Accounting *Accounting and Planning for Farm Management* Dept Primary Industries Brisbane
Hardaker J. B. Lewis J. N. & McFarlane G. C. *Farm Management and Agricultural Economics* A & R
Meredith G. G. Rickards P. A. & Pearse R. A. *Farm Management Accounting: A Commentary* Professional Farm Management Guidebook No 4 2nd ed UNE Armidale
Rickards P. A. & McConnell D. J. *Budgeting, Gross Margins & Programming for Farm Planning* Professional Farm Management Guidebook No 3 UNE Armidale

9.314
Farm Management II — L2

Mathematical programming applications in agricultural industries: linear programming in static and development situations; parametric linear programming; Monte Carlo programming approaches; dynamic programming. Game theory, inventory analysis and other approaches to planning in uncertain or risky situations.

Textbooks

Dent J. B. & Casey H. *Linear Programming and Animal Nutrition* Crosby Lockwood
Heady E. O. & Candler W. *Linear Programming Methods* Iowa State UP
Throsby C. D. *Elementary Linear Programming* Random House

9.315
Farm Management III — L2

Economic aspects of technical agricultural research, with emphasis on the evaluation and interpretation of research results at the farm level. Design and analysis of research projects for estimation of response relationships between rural resources and products. Problems in interpretation and application of these estimates.

Simulation of farm management systems and data requirements for simulation.

Textbooks

Dent J. B. & Anderson J. R. *Systems Analysis in Agriculture* Wiley
Dillon J. L. *The Analysis of Response in Crop & Livestock Production* Pergamon
Heady E. O. & Dillon J. L. *Agricultural Production Functions* Iowa State UP
Naylor T. H. Balintfy J. L. Burdick D. S. & Chu K. *Computer Simulation Techniques* Wiley

9.316
Analysis of Rural Development Projects — L2

Justifications for public investment in rural development. Australian developments in Federal-State financial relationships affecting the planning and evaluation of public development projects.

Evolution of cost-benefit analysis techiques. Theory of cost benefit analysis, and problems in its application, illustrated by case studies.

Input-output models and measurement of the impact of development projects on regional and national economies.

Textbooks

American Economic Association & Royal Economic Society *Surveys of Economic Theory* Vol I 1967 *and* Vol III 1966 Macmillan
Commonwealth of Australia *Investment Analysis—Supplement to the Treasury Information Bulletin* Govt Printing Office Canberra
Davidson B. R. *The Northern Myth* MUP
Eckstein O. *Water Resources Development* Harv. UP
International Engineering Service Consortium *An Economic Study of Keepit Dam* Dept of Conservation Syd 1970
McKean R. N. *Efficiency in Government Through Systems Analysis* Wiley
Mishaw E. J. *Cost Benefit Analysis* Allen & Unwin
Patterson R. A. *The Economic Justification of the Ord River Project* 38th Cong ANZAAS 1965
Subcommittee on Benefits and Costs *Proposed Practices for Economic Analysis of River Basin Projects* Report to the United States Federal Inter-Agency River Basin Committee US Govt Printer 1950

9.411
Agricultural Chemistry I — L1T3

An integrated course 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 — L2T4

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 — L3

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 will be given to nutritional requirements of sheep, those of other farm livestock will be dealt with in this section.

Textbooks

Crampton E. W. *Applied Animal Nutrition* Freeman
Dougherty R. W. et al *Physiology of Digestion in the Ruminant* Butterworths
Maynard L. A. *Animal Nutrition* McGraw-Hill

9.531
Wool Technology I — L4T3

Wool Study: The physical attributes of wool which in combination determine its manufacturing use and commercial value. Wool defects, wool in relation to district, breedtype and environment. Principles of wool classing. Wool marketing and procedures, broking, buying and central classing. Carbonising and fellmongering.

Wool Biology: Structure and function of skin. Follicle and fibre structure. Initiation and maturation of follicle and fibre populations. Wool growth. Significance of wool characteristics and their assessment.

Wool Textile Manufacture: Lectures and laboratory demonstrations cover the principles and practices involved in the conversion of raw materials to yarn. Weaving and finishing of fabrics.

Textbook

Henderson A. E. *Growing Better Wool* A. H. & A. W. Reed

9.532
Wool Technology II — L2

Practical wool sorting, wool classing and appraisal. Objective clip preparation, presale testing and sale by sample. The physical handling and composition of the Australian clip.

Textbook

Dawes K. *Objective Measurement of Wool* NSWUP

9.533
Wool Technology III — L1T2

Wool Metrology: Theories of sampling and measurement of wool characteristics. Laboratory procedures. Chemical and physical testing of raw wool. Estimation of wool damage.

Textbook

Aust. Wool Board *Objective Measurement of Wool in Australia Parts I II and III*

9.534
Wool Technology IV — L2

Raw Materials: Fibres other than wool; their properties, uses and identification.

9.535
Wool Technology V — L1T1

Wool Study: Relationships between subjective appraisal and objective measurement. Sampling and testing of baled bulks from Field Stations and commercial clips. Developments in wool marketing.

Textbook

Dawes K. *Objective Measurement of Wool* NSWUP

9.536
Wool Technology VI — L2T2

Wool Science: Fine structure of the fibre, chemical composition, wool fibre physics, chemical reactivity, mechanical properties and developments in wool technology.

Textbook

Onions W. J. *Wool* Benn

9.601
Animal Physiology I — L2T3

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.

Textbooks

Austin C. R. & Short, R. V. eds *Reproduction in Mammals Vol 1 Germ Cells and Fertilisation Vol 2 Embryonic and Fetal Development Vol 3 Hormones in Reproduction Vol 4 Reproductive Patterns* C.U.P.
Frye B. E. *Hormonal Control in Vertebrates* Macmillan
Fulton J. F. *Textbook of Physiology* Saunders
Perry J. S. *The Ovarian Cycle of Mammals* Oliver & Boyd
Sampson Wright *Applied Physiology* 10th ed OUP

9.602
Animal Physiology II — L2

Major aspects of mammalian physiology relevant to animal production, behavioural physiology, reproduction in the female and lactation, semen physiology. Introductory courses on environmental physiology, lower gut physiology, respiratory gas transport, renal function, the physiology of gene action, ageing and the problem of chemical residues will be given.

9.603
Animal Physiology III — L2T2

Mammalian physiology directed towards domestic livestock production and homeostatic mechanics. Emphasis will be placed upon techniques.

Active transport and allied membrane phenomena. Co-ordinator systems (neural, humoral), reproduction and lactation. Development physiology. General metabolism and its regulation: the physiology and metabolism of specific organs—heart, muscle, liver, kidney. The physiology of the mammalian digestive tract. Environmental physiology; adaptive mechanisms, especially in the newborn, and in heat tolerance, the immune reaction. Electrolyte physiology; acid-base equilibrium of

the organism; use of clearance values in measuring renal and liver activity; respiration; techniques of gas analysis and respirometry. Circulation, cardiac output and distribution (experimental techniques), special vascular circuits (pulmonary, cerebral, hepatic, splenic, renal, testicular). Physiology of the skin.

Textbooks

Cole H. H. & Cupps P. T. eds *Reproduction in Domestic Animals* 2nd ed Academic
Donovan B. T. *Mammalian Neuroendocrinology* McGraw-Hill
Sampson Wright *Applied Physiology* 10th ed OUP

9.801
Genetics I — L2T½

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.

Textbooks

Falconer D. S. *Introduction to Quantitative Genetices* Oliver & Boyd
Fraser A. S. *Heredity, Genes and Chromosomes* McGraw-Hill
Turner H. N. & Young S. S. Y. *Quantitative Genetics in Sheep Breeding* Macmillan.

9.802
Genetics II — L2T2

Genetic structure of populations. Forces causing genetic change. Partition of genetic and phenotypic variation. Resemblance between relatives and estimation of genetic parameters. Direct and correlates 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 to selective progress.

Textbooks

As for 9.801.

9.811
Biostatistics — L2T2

Random sampling. Estimation and tests of significance. Comparison of means. Regression and correlation. Analysis of variance and covariance. Factorial experiments. Multiple and curvilinear regression. Treatment of non-orthogonal data. Analysis of enumeration data. Distribution-free methods. Planning of experiments and surveys.

Textbook

Snedecor G. W. & Cochran W. G. *Statistical Methods* 6th ed Iowa State UP

9.901
Rural Extension — L2T2

Objective and agencies. Research-extension relationships. Educational, psychological and sociological aspects and principles. Program planning involving analysis of the situation, determination of objectives, establishment of priorities and assessment of rural-socio-economic factors. Presentation of programs including aims, educational procedures in presentation, channels and techniques. Evaluation of extension.

Textbook

Rogers E. M. *Diffusion of Innovations* Collier Macmillan

Graduate Study

9.105G
Advanced Livestock Production — L4

Advanced aspects of the principles of animal production with particular emphasis on physiology and endocrinology. Biostatistics and population genetics. Parasites. Management to maximize economic return.

9.503G
Wool Study — L2T4

Place of wool in world trade and the economic life of Australia. Wool quality, fleece defects. Principles of wool processing in relation to the preparation of the clip. Wool areas of the Commonwealth. Wool terms. Types, yield. Wool classing. Wool scouring and carbonizing. Vegetable fault. Methodology of wool commerce. Australian Wool Commission types and valuation.

9.711G
Advanced Wool Technology — L2T2

Biology of fibre growth: histology, fibre arrangement, morphology and fleece genetics. Modern concepts of fibre growth and structure. Advances in fibre physics and fibre chemistry. Wool metrology and conditioning house procedures. Principles of conversion of raw wool to finished goods. Impact of recent developments.

9.902G
Techniques of Laboratory and Field Investigation — L2T2

Experimental method. Design of experiments. The survey approach. Co-operative farm trials. Experiment station investigations. Controlled environmental work in the laboratory. Agronomic studies; plant ecology, plant improvement, field plots, fertilizer trials. Animal studies. Genetic investigations. Fertilization, growth and development. Conversion efficiency for wool, meat and milk. Quality concepts. Special techniques and instrumentation. Small animal techniques. Plant-animal relationships. Grazing management. Economic investigations. Statistical interpretations. Systems analysis and simulation methods.

School of Mathematics

Undergraduate Study

10.001
Mathematics I

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

Preliminary Reading List

Allendoerfer C. B. & Oakley C. O. *Principles of Mathematics* McGraw-Hill
Bell E. T. *Men of Mathematics* 2 vols Pelican
Courant R. & Robbins H. *What is Mathematics?* OUP
Polya G. *How to Solve It* Doubleday Anchor
Sawyer W. W. *A Concrete Approach to Abstract Algebra* Freeman
Sawyer W. W. *Prelude to Mathematics* Pelican

Textbooks

Blatt J. M. *Basic Fortran IV Programming Miditran Version* Computer Systems (Aust)
Shields P. C. *Elementary Linear Algebra* 2nd ed Worth
Thomas G. B. *Calculus and Analytic Geometry* 4th ed Addison-Wesley

10.011
Higher Mathematics I

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

Preliminary Reading List

As for 10.001 plus:
Arnold B. H. *Intuitive Concepts in Elementary Topology* Prentice-Hall
David F. N. *Games, Gods and Gambling* Griffin
Felix L. *The Modern Aspect of Mathematics* Science
Huff D. *How to Lie with Statistics* Gollancz
Reid C. *From Zero to Infinity* Routledge

Textbooks

Fagg S. V. *Differential Equations* EUP
Spivak M. *Calculus* Benjamin
Crowell R. H. & Williamson R. E. *Calculus of Vector Functions* Prentice-Hall
Hochstadt H. *Differential Equations* Holt Rinehart & Winston
Lang S. *Linear Algebra* Addison-Wesley
Murdoch D. C. *Linear Algebra for Undergraduates* Wiley
Spivak M. *Calculus on Manifolds* Benjamin

10.021
Mathematics IT

Calculus, analysis, analytic geometry, algebra, probability theory, elementary computing.

Textbooks

Blatt J. M. *Basic Fortran IV Programming Miditran Version* Computer Systems (Aust)
Greening M. G. *First Year General Mathematics* NSWUP
Youse B. K. & Stalnaker A. W. *Calculus for the Social and Natural Sciences* International Textbook Co

10.022
Engineering Mathematics II

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, eigen values and their numerical evaluation; vector algebra and solid geometry; multiple integrals; introduction to vector field theory.

Textbooks

Giles E. Pretorius W. J. & Prokhovnik S. J. *Supplement to Mathematical Methods* Science Press
Keane A. & Senior S. A. eds *Mathematical Methods* 2nd ed Science Press

10.031
Mathematics

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, eigen values; introduction to numerical methods.

Textbooks

Keane A. Senior S. A. Giles E. & Prokhovnik S. J. *Mathematical Methods* 3rd ed Science Press
(Alternatively: Giles E. Pretorius W. J. & Prokhovnik S. J. *Supplement to Mathematical Methods* Science Press
and Keane A. & Senior S. A. eds *Mathematical Methods* 2nd ed Science Press)

10.032
Mathematics

Vector calculus; special functions; Convolution theorem and applications; complex variable theory; Fourier integrals; Laplace transforms with application to ordinary and partial differential equations.

Textbooks

Keane A. Senior S. A. Giles E. & Prokhovnik S. J. *Mathematical Methods* 3rd ed Science Press
or
Keane A. & Senior S. A. eds *Mathematical Methods* 2nd ed Science Press
and
Giles E. Pretorius W. J. & Prokhovnik S. J. *Supplement to Mathematical Methods* Science Press

10.111A
Pure Mathematics II—Linear Algebra

Vector Spaces: inner products, linear operators, spectral theory, quadratic forms. Linear Programming: convex sets and polyhedra, feasible solutions, optimality, duality.

Textbook

Tropper A. M. *Linear Algebra* Nelson Paperback

10.111B
Pure Mathematics II—Analysis

Real analysis: partial differentiation, multiple integrals. Analysis of real valued functions of one and several variables. Complex analysis: analytic functions, Taylor and Laurent series, integrals, Cauchy's theorem, residues, evaluation of certain real integrals, maximum modulus principles.

Textbooks

Session 1
Kolman B. & Trench W. F. *Elementary Multivariable Calculus* Academic

Session 2
Churchill R. V. *Complex Variables and Applications* ISE McGraw-Hill

10.121A
Higher Pure Mathematics II—Algebra

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

Textbooks

Clark A. *Elements of Abstract Algebra* Wadsworth
Hoffman K. & Kunze R. *Linear Algebra* Prentice-Hall

10.121B
Higher Pure Mathematics II—Real and Complex Analysis

Construction of reals; uniform convergence; implicit and inverse function theorems; analytic functions; Laurent and Taylor series; calculus of residues.

Textbooks

Session 1
Williamson R. E. Crowell R. H. & Trotter H. F. *Calculus of Vector Functions* Prentice-Hall

Session 2
Jamieson G. J. D. *A First Course on Complex Functions* Chapman & Hall
Knopp K. *Elements of the Theory of Functions* Dover

10.211A
Applied Mathematics II—Mathematical Methods

Review of functions of two and three variables, divergence, gradient,

curl; line, surface, and volume integrals; Green's and Stokes' theorems. Special functions, including gamma and Bessel functions. Differential equations and boundary value problems, including vibrating string and vibrating circular membrane; Fourier series.

Textbooks

Sneddon I. N. *Fourier Series* Routledge
Spiegel M. R. *Advanced Mathematics for Scientists and Engineers* Schaum
Spiegel M. R. *Theory and Problems of Vector Analysis* Schaum

10.221A
Higher Applied Mathematics II—Mathematical Methods

As for 10.211A but in greater depth.

Textbooks

Queen N. M. *Vector Analysis* McGraw-Hill
Rabenstein A. L. *Introduction to Ordinary Differential Equations* Academic Int ed

10.331
Stastisics SS

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.

Textbooks

Statistical Tables
Freund J. E. *Mathematical Statistics* 2nd ed Prentice-Hall
or
Kreizig E. *Introductory Mathematical Statistics* Wiley

School of Textile Technology

Undergraduate Study

13.111
Textile Technology I

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. Elementary cloth structures. Warp and weft yarn preparation. Principles of drafting. Cloth setting theories.

Textbook

Booth J. E. *Principles of Textile Testing* 3rd ed National Trade Press

13.112
Textile Technology II

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. Compound cloths, extra threads. Jacquard woven fabrics. Woven fabric analysis. Principles of knitting. Basic warp and weft knitted structures. Elementary knitted fabric geometry. The mechanics of loop formation. *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.

Textbook

Peters R. H. *Textile Chemistry* Vol 2 Elsevier

13.113
Textile Technology III

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:* Pile fabric production, tapestries, gauzes and carpets. Pirnless weaving. Narrow fabric weaving. Circular weaving. Tufting, non-woven fabrics. Double knit structures and mechanisms. Needle selection for fabric decoration. Loop transfer for decoration and garment shaping. Hosiery manufacture. Multi-bar warp knitting. Laid-in fabrics. Raschel knitting. Stitch bonded fabrics. Basic garment assembly. *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

Production, properties and uses of textile fibres. Fibres, rubbers and plastics. Addition and condensation polymerisation. Chemical constitution and reactivity of the natural and man-made fibres. Optical microscopy and birefringence 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.

Textbook

Peters R. H. *Textile Chemistry* Vol 1 Elsevier

13.212
Textile Science II

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. Polymerisation kinetics, molecular weights of polymers, copolymers. Properties of surfactant solutions, micelle formation, surfactants as emulsifiers and detergents, detergency.

Textbook

Hearle J. W. S. Grosberg P. & Backer S. *Structural Mechanics of Fibres, Yarns and Fabrics* Vol 1 Interscl

13.213
Textile Science III

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.

Textbook

Wright W. D. *The Measurement of Colour* 4th ed Adam Hilger

13.223
Advanced Textile Chemistry

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

Textbook

Bird C. L. & Boston W. S. *The Theory of Coloration of Textiles* Dyers Co Publ Trust

13.233
Advanced Textile Physics

(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

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

Fluid flow. Applied heat, steam, air and heat transfer, air conditioning. Elements of automatic control. Introduction to Methods Engineering.

13.313
Advanced Textile Engineering

(a) Same as (a) in 13.233 Textile Physics.
(b) Heat and mass transfer. Conveying of gases, fluids and solids.

School of Psychology

Undergraduate Study

12.001
Psychology I

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

Textbooks

CRM *Psychology Today: An Introduction* 3rd ed CRM Books
or
Hilgard E. R. Atkinson R. C. & Atkinson R. L. *Introduction to Psychology* 6th ed Harcourt Brace & Jovanovich
Lumsden J. *Elementary Statistical Method* WAUP
Selected *Scientific American* reprints, as advised by the School

School of Accountancy

Undergraduate Study

14.081
Introduction to Financial Analysis

Aims to provide students, other than those enrolled within the Faculty of Commerce, with an understanding of the basic concepts and principles necessary 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.

Textbook

Pierson G. & Bird R. *Business Finance* McGraw-Hill,

14.501
Accounting and Financial Management IA

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.

Textbooks

Carrington A. S. Battersby G. B. & Howitt G. *Accounting—An Information System* Whitcombe & Tombs
Haskell D. J. Howitt G. Kingston N. & Williams J. F. *Exercises and Solutions in Accounting and Financial Management* UNSW
May R. G. Mueller G. G. & Williams T. H. *A New Introduction to Financial Accounting* Prentice-Hall

14.511
Accounting and Financial Management IB

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.

Textbooks

As for Accounting and Financial Management IA

14.602
Information Systems

Management information systems, including data collection and processing, internal control and internal reporting. System design and computer applications.

Textbooks

Alexander M. J. *Information Systems Analysis* Science Research Associates
Forkner I. & McLeod R. Jnr *Computerised Business Systems* Wiley
Grouse P. J. *An Introduction to Computer Programming in PL/1 Part 1 The Simple Subset* 2nd ed New College Publications

School of Economics

Undergraduate Study

15.001
Economics IA

Microeconomic analysis as related to some aspects of the Australian economy, including the concept of market demand, the theory of costs and production, supply and demand analysis, the determination of exchange rates, the effects of taxes, tariffs, subsidies and quotas, price and output determination under competitive and other market structures, an introduction to distribution theory and the application of economic analysis to contemporary problems.

Textbooks

Tisdell C. A. *Economics of Markets: An Introduction to Economic Analysis* Wiley
Tisdell C. A. *Workbook to Accompany Economics of Markets* Wiley

15.011
Economics IB

Macroeconomic analysis as related to some aspects of the Australian economy, including national income and product, money and banking, consumption, investment, liquidity preference, the Keynesian model of income determination and economic growth.

Textbooks

Australian National Accounts: National Income and Expenditure 1973-1974 *Australian Bureau of Statistics* 1975
Rowan D. C. *Output, Inflation and Growth* Aust ed Macmillan

15.002
Economics IIA

Microeconomic theory, including consumer theory, production theory, types of competition, market stability and general equilibrium.

Textbook

Ferguson C. E. *Micro-Economic Theory* 3rd ed Irwin

15.022
Economics IIB

An introduction to welfare economics and its application to some contemporary problems of public policy.

Textbooks

Ferguson C. E. *Micro-Economic Theory* 3rd ed Irwin
Layard R. ed *Cost-Benefit Analysis* Penguin
Mishan E. J. *Cost-Benefit Analysis* Allen & Unwin

15.042
Economics IIC

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.

Textbooks

Branson W. H. *Macroeconomic Theory and Policy* Int ed Harper
Nevile J. W. *Fiscal Policy in Australia* 2nd ed Cheshire
Rowan D. C. *Output Inflation and Growth* Aust ed Macmillan
Wrightsman D. *An Introduction to Monetary Theory and Policy* Free Press

15.082
Labour Economics

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; 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.

Textbooks

Horn R. V. *Australian Labour Market Economics* Cheshire
Niland J. R. & Isaac J. R. eds *Australian Labour Economics Readings* Sun Books
Rees A. *The Economics of Work and Pay* Harper & Row

15.003
Economics IIIA

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.

Textbooks

Branson W. H. *Macroeconomic Theory and Policy* Int ed Harper
Makin J. H. *Macroeconomics* Holt Saunders
Nevile J. W. *Fiscal Policy in Australia* 2nd ed Cheshire
Nevile J. W. & Stammer D. eds *Inflation and Unemployment* Pelican

15.023
Economics IIIB

International trade and investment, tariffs and other restrictions, the balance of payments, external balance, the international monetary system.

Textbooks

Caves R. E. & Jones R. W. *World Trade and Payments: An Introduction* Little Brown
McColl G. D. ed *Overseas Trade and Investment* Pelican

15.043
The Soviet Economy

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.

Textbooks

Bernard P. I. *Planning in the Soviet Union* Pergamon Press
Campbell R. W. *Soviet-type Economics* Macmillan
Dirlam J. B. & Plummer J. L. *An Introduction to the Yugoslav Economy* Merrill

15.053
Economic Development

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.

Textbooks

Bernstein H. *Underdevelopment and Development* Penguin
Spiegelglas S. & Welsh C. J. eds *Economic Developments* Prentice-Hall
Sutcliffe R. B. *Industry & Underdevelopment* Addison-Wesley

15.073
Natural Resource Economics

Nature of natural resources and rents, optimization of natural resource use in space and time, decision criteria in natural resource policy, natural resources and the intangible qualities of life.

Textbooks

Barnett H. J. & Morse C. *Scarcity and Growth: The Economics of Natural Resource Availability* Johns Hopkins UP
Dorfman R. & N. eds *Economics of the Environment* Norton

15.093
Public Sector 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.

Textbooks

Layard R. ed *Cost-Benefit Analysis* Penguin
Millward R. *Public Expenditure Economics* McGraw-Hill
Munby D. ed *Transport* Penguin
Turvey R. ed *Public Enterprise* Penguin
Turvey R. *Economic Analysis and Public Enterprises* Allen & Unwin

15.601
Economic History IA—The Making of Modern Economic Society

The purpose of this course is to provide a survey of the forces that have determined the pattern and course of economic development in the later nineteenth and twentieth centuries. Stages of economic development; the transformation of agrarian society; the triumph of industrialism and liberal democracy. Pax Britannica and the European hegemony. The First World War and capitalist society in crisis; competing forms of political and economic organization; shifts in world power. The quest for unity in Europe. Problems of affluence in advanced industrial economies. The development of the administrative state and the multi-national corporation. The progress of the underdeveloped nations.

Preliminary Reading

Hohenberg P. M. *A Primer on the Economic History of Europe Part 1**

Textbooks

Hughes J. *Industrialization and Economic History* McGraw-Hill*
Kenwood A. G. & Lougheed A. L. *The Growth of the International Economy: 1820-1960* Australasian Pub Co*

15.611
Economic History IB—Australian Economic Development in the Twentieth Century

The aim of the course is to delineate and explain the origins and evolution of the modern Australian economy from Federation 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; the impact of war on the Australian economy; 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.

Preliminary Reading

Alexander F. *Australia since Federation* Nelson*

Textbooks

Boehm E. A. *Twentieth Century Economic Development in Australia* Longman*
Forster C. ed *Australian Economic Development in the Twentieth Century* Allen & Unwin*
Schedvin C. B. *Australia and the Great Depression* Sydney UP
Wheelwright E. L. & Buckley Ken eds *Essays in the Political Economy of Australian Capitalism* Vol I Australian and New Zealand Book Co*

Biological Sciences

Undergraduate Study

17.011
Biology of Mankind

Mankind Evolving: Primate evolution; background of early man.

Evolution of Technological Man: Biological problems associated with communication and tool-making; development of man as a hunting predator.

Development of Utilization of Natural Resources: Development of man as a pastoralist and farmer; animal and plant domestication.

Evolution of Urban Man, Culture, Society: Reproductive biology and genetics of man; population growth, fluctuation, control; natural history of disease, background of medical and industrial microbiology.

Effects of Modern Society: Biology of social stress; effect of society in contemporary environments, planning and control.

Textbooks

Abercrombie M. et al *A Dictionary of Biology* Penguin
Boughey A. S. *Man and the Environment* 2nd ed Macmillan

17.021
Comparative Functional Biology

Maintenance of the Organism: Gas exchange systems in plants and animals; transport inside organisms; uptake, digestions, absorption; enzymes structure and function; photosynthesis, process and structural relationships; metabolic systems, energy yields and pathways.

Developing Organisms: Sexual reproduction in plants and animals; general life cycle patterns; cell development and differentiation in flowering plants and mammals.

Control and Co-ordination in Organisms: Organisms and water, uptake and effects; control mechanisms, urinary systems and kidney structure and function; stimuli and responses, plant hormones, hormones in vertebrate animals, muscle activity and muscle structure, eye structure and vision mechanism; ear structure and hearing mechanism; nerves, central nervous system, nerve action, brain structure and functioning.

Textbooks

Abercrombie M. et al *A Dictionary of Biology* Penguin
Roberts M. B. V. *Biology: Functional Approach* Nelson

* Paperback.

Department of Industrial Engineering

Undergraduate Study

18.121
Production Management — S1 + S2 L3T0

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, queuing theory, inventory models, simulation.

Textbooks

Buffa E. S. *Modern Production Management* 3rd ed Wiley
Lu F. P. S. *Economic Decision-making for Engineers and Managers* Whitcombe & Tombs
Moore P. G. *Basic Operational Research* Pitman

18.551
Operations Research — S1 + S2 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.

Textbook

Taha H. A. *Operations Research: An Introduction* Macmillan

School of Chemical Technology

Undergraduate Study

22.112
Chemical Process Equipment — L1

Co- or prerequisite: 2.001.

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 — 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 will be required to attend lectures on Report Writing, carry out laboratory assignments and attend factory inspections at local and country centres as required.

Textbook

Kent J. A. *Riegel's Industrial Chemistry* Reinhold
or
Shreve, R. N. *Chemical Process Industries* McGraw-Hill

22.114
Processes — S2 L2

Prerequisite: 22.113.

Topics selected from the following will be 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.

22.122
Instrumental Analysis — L1T2

Prerequisites: 1.001, 2.001. Co- or prerequisite: 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.

Textbook

Skoog D. A. & West D. M. *Fundamentals of Analytical Chemistry* Holt Rinehart
or
Skoog D. A. & West D. M. *Principles of Instrumental Analysis* Holt Rinehart

22.123
Chemical Thermodynamics and Kinetics — 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.

Textbooks

Smith J. M. *Chemical Engineering Kinetics* McGraw-Hill
Smith N. O. *Chemical Thermodynamics—A Problems Approach* Reinhold

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; semi-batch reactors; tubular reactors; fixed bed catalytic reactors; optimization; scale-up of reactors; residence time distributions.

Textbook

Smith J. M. *Chemical Engineering Kinetics* McGraw-Hill

22.132
Industrial Chemistry Calculations L1

Prerequisites: 2.001, 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 L2T1 S2 L2T2

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 χ^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.

Textbooks

Crow E. L. Davis F. A. & Maxfield M. W. *Statistics Manual* Dover
Dorn W. S. & McCracken D. D. *Numerical Methods with Fortran IV Case Studies* Int ed Wiley*
McCracken D. D. *A Guide to Fortran IV Programming* 2nd ed Wiley*

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 multicomponent 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.

22.144
Instrumentation and Process Control S1 L4T4

Prerequisites: 1.212B, 10.031.

Instrumentation (primary sensitive elements and final control elements concerned with the parameters normally encountered in the chemical industry), elementary principles of digital computation, process dynamics, open-loop process system analysis, principles of analogue computation and simulation, automatic process control systems.

Textbooks

Karbowiak A. E. & Huey R. M. eds *Information, Computers, Machines and Man* Int ed Wiley
Luyben W. L. *Process Modelling, Simulation and Control for Chemical Engineers* McGraw-Hill

22.153
Material and Energy Balances S1 L1T2

Prerequisites: 2.002A, 10.031, 22.132. Co- or prerequisite: 22.123.

Units, material balances, gases, vapours and liquids, energy balances, combined energy and material balances, unsteady-state material and energy balances.

Textbook

Himmelblau D. M. *Basic Principles and Calculations in Chemical Engineering* 2nd ed Prentice-Hall

22.154
Process Simulation S2 L2T2

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.

Textbooks

Karbowiak A. E. & Huey R. M. eds *Information, Computers, Machines and Man* Int ed Wiley
Luyben W. L. *Process Modelling Simulation and Control for Chemical Engineers* McGraw-Hill
Mearns A. M. *Chemical Engineering Process Analysis* Oliver & Boyd

22.163
Instrumentation and Process Control I S2 L1½T1½

Prerequisites: 1.212B, 10.031, 22.122 or 2.002D.
Co- or prerequisites: 22.113 or 22.2331.

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.

Textbooks

Karbowiak A. E. & Huey R. M. eds *Information, Computers, Machines and Man* Int ed Wiley
Luyben W. L. *Process Modelling Simulation and Control for Chemical Engineers* McGraw-Hill

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.

* Paperback.

Textbooks

Karbowiak A. E. & Huey R. M. eds *Information, Computers, Machines and Man* Int ed Wiley
Luyben W. L. *Process Modelling Simulation and Control for Chemical Engineers* McGraw-Hill

22.174
Seminars T3

Co- or prerequisite: 22.184.

Students will be 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 will be taken, where appropriate, to arrange for guest lecturers.

22.184
Process Analysis S1 T1 S2 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.

Textbook

Mearns A. M. *Chemical Engineering Process Analysis* Oliver & Boyd

22.213
Chemical Ceramics S1 L2T2 S2 L2T4

Prerequisites: 2.002A, 2.002C, 2.002D.
Co- or prerequisites: 22.123A, 22.2331, 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.

Textbook

Ford W. F. *Institute of Ceramics Textbook Series, IV Effect of Heat on Ceramics* Maclaren

22.224
Physical Ceramics L3T3

Prerequisites: 22.213, 22.2331.

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.

Textbooks

Budworth D. W. *An Introduction to Ceramic Science* Pergamon
Kingery W. D. *Introduction to Ceramics* Wiley

22.231
Introductory Ceramic Engineering

The nature of ceramic materials, the history of ceramics and the ceramic industry, the structure of the ceramics industry and the role of the ceramic engineer.

22.2331
Ceramic Process Principles L1½T2½

Clay and non-clay raw materials; unit operations in the ceramic industry; beneficiation, forming, drying, firing, melt forming, hot forming and miscellaneous forming process. Testing methods and instrumentation in quality control. Stoichiometry and ceramic calculations, including glaze, porcelain enamel and body formulation.

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

Textbooks

Ford R. W. *Institute of Ceramics Textbook Series, III. Drying* Maclaren
Griffiths R. & Radford C. *Calculations in Ceramics* Maclaren
Moore F. *Institute of Ceramics Textbook Series, II. Rheology of Ceramic Systems* Maclaren
Worral W. E. *Institute of Ceramics Textbook Series, I. Raw Materials* Maclaren

22.2332
Ceramic Engineering I L1

Co- or prerequisites: 3.311, 7.023/2, 22.2331.

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.

22.234
Ceramic Engineering II L2T2

Prerequisites: 3.111, 8.112, 22.2331, 22.2332.

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. Power transmissions. Pollution control equipment.

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

22.294
Project S1 T3 S2 T12

Prerequisites: 22.213, 22.2331, 10.331.
Co- or prerequisites: 22.224, 22.234.

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 molecular 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.

Textbooks

Lenz R. W. *Organic Chemistry of Synthetic High Polymers* Wiley
Cowie J. M. G. *Polymers, Chemistry and Physics of Modern Materials* Intertext
Treloar L. R. G. *The Physics of Rubber Elasticity* Clarendon
McKelvey J. M. *Polymer Processing* Wiley

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.

Textbook

McKelvey J. M. *Polymer Processing* Wiley

22.341
Statistical Techniques — S1 L1T1

Prerequisite: 10.331.

The application in the Polymer industry of the z test, t test, χ squared test and F test, correlation of one and two variables, single factor and two factor analysis of variance.

Textbook

Crow E. L. Davis F. A. & Maxfield M. W. *Statistics Manual* Dover

Graduate Study

22.110G
Process Evaluation — S1 + S2 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
Catalysis 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 dynamic 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 — S1 + S2 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 electrodics, 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 — S1 + S2 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 fuels; solid state electrolytes; biodegradation of rocks and minerals. Chemical strengthening of ceramics.

22.220G
Refractory Technology — S1 + S2 L4T2

Nature of refractories. Methods of manufacture and forms of refractories. Characterization of raw materials. The composition, structure, properties and production of typical refractory materials such as silica, alumina silicates, high alumina, basic materials and zircon. Special single and mixed oxides, carbides, nitrides and oxynitrides. Kiln furniture, insulating products, refractory mortars and specialty products.

Refractory evaluation tests. Chemical, mechanical and thermal properties: hot and cold modulus of rupture, cold crushing strength, refractoriness under load, creep resistance, thermal conductivity, thermal shock resistance, pyrometric cone equivalent, size stability, abrasion resistance, chemical resistance. Examination of macro- and microstructures of refractories by optical microscopy of thin and polished sections, scanning electron microscopy, transmission electron microscopy, microprobe analysis. Behaviour of refractories in service.

Chemical, physical and mechanical behaviour in typical installations. Discussions of case histories from ferrous and non-ferrous metallurgical industries, glass manufacture, boiler installations, cement and lime kilns and the aerospace and nuclear industries.

Laboratory experiments and demonstrations will form part of the course.

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, antioxidants 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.

School of Nuclear Engineering

Graduate Study

23.051
Nuclear Power Technology — L2½T½

Nuclear processes, reaction rates, fission and energy release. Neutron multiplication, slowing down and diffusion. Nuclear reactor criticality and burnup, neutron kinetics and reactor control.

Thermal and fast reactor types, operation, environmental and safety aspects. Nuclear fuel enrichment and utilization, nuclear power costing and economics.

Heat generation and removal, fluid dynamics and heat transfer aspects of gas and liquid coolants, boiling, two phase flow and burnout. Structural mechanics in reactor technology, thermomechanical performance of fuel pins and pressure vessels.

School of Applied Geology

Undergraduate Study

25.011
Geology I

Physical Geology: The origins, structure and main surface features of the earth; geological cycle: processes of erosion, transportation, sedimentation and lithification. Surface and sub-surface water. Weathering, lakes, rivers, glacial phenomena. Vulcanism, earthquakes, orogenesis and epeirogenesis, integrated theory of plate tectonics and continental drift.

Crystallography and Mineralogy: Crystal symmetry, systems, forms, habit, twinning. Occurrence, form and physical properties of minerals. Mineral classification. Descriptive mineralogy. Principal rock forming minerals. Basic structures of silicate minerals.

Petrology: Field occurrence, lithological characteristics and structural relationships of igneous, sedimentary and metamorphic rocks. Coal, oil and ore deposits.

Stratigraphy and Palaeontology: Basic principles of stratigraphy; introductory palaeontology. The geological time scale. The geological history of the Australian continent and more specifically that of New South Wales in introductory outline.

Practical Work: Preparation and interpretation of geological maps and sections. Map reading and use of simple geological instruments. Study of simple crystal forms and symmetry. Applied stereoscopic projection. Identification and description of common minerals and rocks in hand specimen. Recognition and description of examples of important fossil groups. Supplemented by four field tutorials, attendance at which is compulsory.

Textbooks

Bickford M. E. *et al Geology Today* CRM Books
Black R. M. *Elements of Palaeontology* C.U.P.
Rutley F. *Elements of Mineralogy* Read H. H. ed Murby
Tyrrell G. W. *The Principles of Petrology* Methuen

25.012
Geology IIA

Structural Geology: Origin, classification and description of structures in sedimentary, igneous, and metamorphic rocks. The stereographic projection of structural elements, and analysis of simple fracture and fold systems. Tectonics.

Mineralogy, Igneous and Metamorphic Petrology: Principles of optical crystallography and the use of the polarizing microscope. Chemical and physical properties of the main groups of minerals. Occurrence, genesis and classification of igneous rocks. Magmatic crystallization and differentiation. Simple binary and ternary systems. Origin and classification of metamorphic rocks. ACF and AKF diagrams and metamorphic facies. *Practical:* Mesoscopic and microscopic examination of rock forming and ore minerals, igneous and metamorphic rocks.

Photogeology: The use of air photos for geological mapping and geomorphological evaluation of land. Techniques and principles of photo interpretation, multi-band photography; landform genesis and photo interpretation of folds, faults, joints, bedding, limestone, intrusive igneous rocks, volcanics. alluvial fans and terraces, slopes, landslides, coastal arid and tropical landforms; relations between geology, drainage, soil and vegetation; orebody expression, gossans, colouration halos.

Textbooks

Structural Geology
Ragan D. M. *Structural Geology—An Introduction to Geometrical Techniques* 2nd ed Wiley
Spencer E. W. *Introduction to the Structure of the Earth* McGraw-Hill

Mineralogy, Igneous and Metamorphic Petrology:
Bloss F. D. *An Introduction to the Methods of Optical Crystallography* Holt Rinehart & Winston
Heinrich E. W. *Microscopic Identification of Minerals* McGraw-Hill
Turner F. J. & Verhoogen J. *Igneous and Metamorphic Petrology* McGraw-Hill

Photogeology:
Von Bandat H. F. *Aerogeology* Gulf Pub.

25.022
Geology IIB

Stratigraphy and Palaeontology

Stratigraphy: Flow regime and bedding forms including flume experiments, sedimentary structures. Modern and ancient environments of deposition: fluvial, deltaic coastal, shelf, slope and deep sea environments. The facies concept. Stratigraphic principles. Fold Belts, geosynclines and their interpretation by plate tectonics models. Stratigraphic and structural development of a fold belt (Lachlan Fold Belt) and an intraeratonic basin (Sydney Basin).

Palaeontology: Morphology and stratigraphic distribution of the Protozoa, Porifera, Coelenterata, Bryozoa, Brachiopoda and Mollusca. Practical examination of representative fossils from each phyla.

Textbooks

Blatt H. Middleton G. & Murray R. *Origin of Sedimentary Rocks* Prentice-Hall
Brown D. A. Campbell K. S. W. & Crook K. A. W. *Geological Evolution of Australia and New Zealand* Pergamon
Dunbar C. O. & Rodgers J. *Principles of Stratigraphy* Wiley
Moore R. C. Laficker C. G. & Fischer A. G. *Invertebrate Fossils* McGraw-Hill

25.013
Geology IIIA

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.

Textbooks

Economic Geology A
Park C. F. & MacDiarmid R. A. *Ore Deposits* 2nd ed Freeman
Stanton R. L. *Ore Petrology* McGraw-Hill

Mineralogy and Petrology
Carmichael I. S. Turner F. J. & Verhoogen J. *Igneous Petrology* McGraw-Hill
Blatt H. Middleton G. & Murray R. *Origin of Sedimentary Rocks* Prentice-Hall

25.023
Geology IIIB

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:* Introductory course in exploration geophysics covering the following methods: seismic, electrical, electromagnetic, gravity, magnetic and radioactive with applications 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.

Textbooks

Geophysics

Bott M. H. P. *The Interior of the Earth* Arnold
Dobrin M. B. *Geophysical Prospecting* McGraw-Hill

Stratigraphy and Palaeontology

As for Stratigraphy and Palaeontology in 25.022 with:
Krumbein W. C. & Sloss L. L. *Stratigraphy and Sedimentation* Freeman

25.033
Geology IIIC

Mathematical Geology and Geological Surveying

Mathematical Geology: An introduction to the 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 recrystallisation. Metamorphic petrology of Australia.

Practical: Macroscopic and microscopic study of igneous 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 paleoecological 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.

Textbooks

Mathematical Geology and Geological Surveying

Davis J. C. *Statistics and Data Analysis in Geology* Wiley
Blatt J. *Introduction to FORTRAN programming* Prentice-Hall
Davis R. E: Foote F. S. & Kelly J. W. *Surveying* McGraw-Hill

Geochemistry and Petrology

Ahrens L. H. *Distribution of the Elements in our Planet* McGraw-Hill
Zussman J. *Physical Methods in Determinative Mineralogy* Academic
Loughnan F. C. *Chemical Weathering of the Silicate Minerals* Elsevier
Miyashiro A. *Metamorphism and Metamorphic Belts* Allen & Unwin

Advanced Structural Geology

As for Geology II together with:
Turner F. J. & Weiss L. E. *Structural Analysis of Metamorphic Tectonites* McGraw-Hill

Sedimentary Basin Analysis and Geology of Hydrocarbons

As for Structural Geology II and Stratigraphy II & III together with:
Ager D. V. *Principles of Palaeoecology* McGraw-Hill

Economic Geology B, Mineragraphy and Experimental Petrology

Economic Geology of Australia and Papua New Guinea Aus Inst Min Met Melbourne
Edwards A. B. *Textures of the Ore Minerals* 2nd ed Aus Inst Min Met Melbourne
Carmichael I. S. Turner F. J. & Verhoogen J. *Igneous Petrology* McGraw-Hill

Micropalaeontology

Glaessner M. F. *Principles of Micropalaeontology* MUP 1955 Hafner reprint 1963

Surficial Geology

Hunt C. B. *Geology of Soils, Their Evolution, Classification and Uses* Freeman
Thornbury W. D. *Principles of Geomorphology* 2nd ed Wiley*

Geology IV

The course consists of 25.014, 25.024, 7.023 *or* 25.074, plus *one* option chosen from 25.034, 25.044, 25.054 and 25.064.

25.014
Advanced Applied Geology

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.

Textbooks

Computer Applications in Geology

Davis J. C. *Statistics and Data Analysis in Geology* Wiley

Exploration Geophysics

Dobrin M. D. *Introduction to Geophysical Prospecting* 2nd ed McGraw-Hill
Parasnis D. S. *Mining Geophysics* 2nd ed Elsevier

25.024
Project

An individual field assignment carried out under supervision and consisting essentially of geological mapping plus supporting laboratory work.

Options

25.034
Engineering Geology

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 rocks. 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 cartography and map projections. Principles of photogrammetry.

Textbooks

Heath R. C. & Trainor F. W. *Introduction to Groundwater Hydrology* Wiley
Krynine D. P. & Judd W. R. *Principles of Engineering Geology and Geotechnics* McGraw-Hill
Davies R. E. Foote F. S. & Kelly J. W. *Surveying* McGraw-Hill

25.044
Mineral Exploration

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.

Textbooks

Lawrence L. J. *Exploration and Mining Geology* Aus Inst Min Met Melbourne
Jenkins R. & de Vries L. *Practical X-ray Spectrometry* 2nd ed Philips Tech Library Eindhoven

25.054
Sedimentary Basins

Lectures, tutorials and a laboratory project in Advanced Sedimentology, Palaeontology, Palaeoecology and Petroleum Geology.

Textbooks

Levorsen A. I. *Geology of Petroleum* 2nd ed Freeman
Loeblich A. R. & Tappan H. *The Treatise on Invertebrate Palaeontology—Part C Protista* Geol Soc America 1964

25.064
Applied Geophysics

Exploration and applied geophysics, its practice, theory and interpretation in petroleum, mining and engineering exploration and in applied geology.

Textbook

Grant F. S. & West G. F. *Interpretation Theory in Applied Geophysics* McGraw-Hill

25.074
Special Project

A field-laboratory project related to the option selected by the student.

* Paperback.

25.0303
Geology for Geomorphologists and Pedologists

Prerequisites: Geoscience II A and B.

Clay Mineralogy: The structure and properties of clay minerals. Techniques for their recognition. Clay-water systems and ion exchange. Some applied aspects of clay mineralogy. Laboratory work to illustrate the above course.

Sedimentary Petrology: The chemistry of rock weathering. The chemically formed sedimentary rocks including the phosphates, zeolites, evaporites, ferruginous and siliceous deposits. The distribution of trace elements in sedimentary rocks.

Sedimentology: Methods of sediment analysis and sediment parameters. Laboratory flume experiments. Selected stratigraphic topics.

Textbooks

Folk R. L. *Petrology of Sedimentary Rocks* Univ of Texas Press
Loughnan F. C. *Chemical Weathering of Silicate Minerals* American Elsevier
Milner H. B. *Sedimentary Petrography* 4th ed Arnold

25.101
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. Physical properties of rocks including porosity, permeability and capillarity. Weathering processes of rocks and minerals. Deformation of rocks and the resulting effects such as folds, faults, joints and foliation. An introduction to modern theories of tectonism. Integration of geological observations.

Practical Work: Laboratory work consists of exercises related to the Lecture course: geological mapping including structure contour problems. Study of minerals and rocks in hand specimens.

Field Tutorials: Two field tutorials are conducted at which attendance is compulsory. Satisfactory reports must be submitted.

Note Total hours: 56. The course is divided equally between lectures and laboratory work. Field Tutorial hours are additional.

Textbooks

Blyth F. G. H. & Defritas M. H. *A Geology for Engineers* 6th ed Arnold
Ernst W. G. *Earth Materials* Prentice-Hall
Rutley F. *Elements of Mineralogy* Read H. H. ed 26th ed Murby

25.102
Geology for Engineers II

Palaeontology and stratigraphy: An introduction to invertebrate palaeontology, and palaebotany as applied to stratigraphy. The principles of stratigraphy. Stratigraphic correlation. Various methods used in dating of rocks. Brief outline of the geological evolution of Australasia.

Practical Work: The study of fossils in hand specimens. Relative age interpretation using geological maps and stratigraphic correlation diagrams.

Structural geology: A detailed study of the structural aspects of folds, faults, joints of metamorphic, igneous and sedimentary rocks, including regional stress distribution. Analysis of geological structures using stereographic methods.

Practical Work: Structural problems using stereographic methods. Structural analyses of complex terrains using geological maps.

Energy sources: The nature and origin of coal and coal seams including type and rank. The origin of oil and gas and their mode of accumulations. The mode of formation and occurrence of water resources.

Practical Work: Study of coal in hand specimens and under the microscope.

Ore Deposits: The mineralogy of metallic and non-metallic minerals of industrial importance. Principles and theories of ore formation within the igneous, metamorphic and sedimentary cycles. Structural control of ore deposition. Aspects of weathering and secondary enrichment processes in relation to ore deposits.

Practical Work: Study of economic minerals and ores in hand specimens and in polished sections using polarised reflected-light microscopy.

Mineral Exploration: Theory and application of exploration techniques: geochemical methods and remote sensing methods. Design and implementation of an exploration program. Ore appraisal and financial aspects of exploration. Sampling methods.

Practical Work: Feasibility interpretations of geological maps. Structure contour mapping as applied to surface and underground mining. Ore reserve estimations.

Geophysics: The principles, methods and applications of geophysical exploration viz gravity, magnetic, electrical, seismic, radioactive and miscellaneous.

Practical Work: Demonstration of geophysical instruments. Interpretation of geophysical data.

Field Tutorials: Field Tutorial(s) are conducted during the Semester. Attendance is compulsory and satisfactory reports are to be submitted.

Textbooks

Brown D. A. Campbell K. S. W. & Crook K. A. W. *The Geological evolution of Australia and New Zealand* Pergamon
Ragan R. *Structural Geology* 2nd ed Wiley
Rutley F. *Elements of Mineralogy* Read H. H. ed 26th ed Murby London
Park F. Jr Roy A. MacDiarmid *Ore Deposits* 2nd ed Freeman
Lawrence L. J. ed *Exploration and Mining Geology* Vol 2 8th Commonwealth Min and Met Congress 1965

25.1021
Geology for Mining Engineers (BSc(Tech) and BSc(Eng))

An abridged version of 25.102.

Occurrence and structures of igneous rocks, consolidation of magmas, igneous rock classification. Thermal and regional metamorphism. Composition and classification of sedimentary rocks—sedimentary environments. Ore genesis, synmagmatic, epimagmatic and post-magmatic processes, volcanic exhalative deposits, sedimentary biogenetic deposits. Structural control of ore deposits. Alluvial deposits, non-metallic ores. Nature, origin and occurrence of coal and petroleum. Type and rank variation, coal petrology, coalfield geology. Geological evolution of the Australian continent from Pre-Cambrian to Recent times. Introductory geophysics—methods and applications. *Laboratory:* macroscopic and microscopic study of rocks and minerals. Ore mineralogy and mineragraphy. Coal petrology. Study of more common plant and animal fossils. Stratigraphic and other forms of geological mapping.

25.141
Advanced Engineering Geology

Prerequisite or co-requisite: 8.272 Civil Engineering Materials I.

The fabric of rocks at various scales; fabric analysis at the mesoscopic scale; 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. Petrography of rock and earth construction materials; fabric changes with weathering; soil fabrics; engineering aspects, and engineering classification, of weathered rocks.

Textbook

Ragan D. M. *Structural Geology* 2nd ed Wiley

25.201
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.

Textbooks

Hurlbut C. S. ed *Dana's Manual of Mineralogy* Wiley
Rutley F. *Elements of Mineralogy* Read H. H. ed 26th ed Murby

Graduate Study

25.121G
Engineering Geology

Design and execution of site investigation projects. Terrain evaluation. Discontinuities in rock masses; analysis, influence on engineering properties of rocks. Microfabric and microtexture of rocks. Residual tectonic stresses. Engineering classification and description of weathered rocks and soils. Discontinuities, anisotropy, and weathering in design and construction. Residual tectonic stress fields. The geological and geomorphic bases of slope stability analyses. Transmission of vibrations through rock and soil. Aseismic design. Laboratory work will be related to the lecture course.

Textbook

Phillips F. C.*The Use of the Stereographic Projection in Structural Geology* Arnold

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 irregular 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 electromagnetic methods. Theory of electromagnetic induction and electromagnetic 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-hole logging in petroleum engineering and mineral exploration.

Textbooks

Grant F. S. & West G. F. *Interpretation Theory in Applied Geophysics* McGraw-Hill
Keller G. V. & Frischknecht F. C. *Electrical Methods in Geophysical Prospecting* Pergamon

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 inhomogenous 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. Analogue 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 in 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 Techniques, and of Downhole Geophysical Methods: Practical interpretation of well log data.

Textbooks

Grant F. S. & West G. F. *Interpretation Theory in Applied Geophysics* McGraw-Hill
Keller G. V. & Frischknecht F. C. *Electrical Methods in Geophysical Prospecting* Pergamon

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; computerised 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, Mining Law and Management

Principles of mineral economics, metal prices, price fluctuation, 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 course is directed particularly, but not exclusively, toward the Field Project.

25.402G
Hydrogeology

Surface and sub-surface methods of geological and geophysical investigation; well logging; lithology and structure of rocks in relation to groundwater storage and quality. Geological characteristics of aquifers. Hydrogeological maps. Hydrogeological systems analysis, including computer methods. Hydrogeology of arid and semi-arid zones. Groundwater resources evaluation. Case history studies. The laboratory work will include the study and interpretation of hydrogeological data. A field tutorial is included in the course.

Textbooks

Walton W. C. *Groundwater Resource Evaluation* McGraw-Hill
Davis S. N. & De Wiest R. J. M. *Hydrogeology* Wiley
Heath R. C. & Trainor F. W. *Introduction to Groundwater Hydrology* Wiley

25.404G
Environmental Geology

Geological hazards: seismic risk, landslides, subsidence, floods, erosion, volcanic eruptions, discrete and continuous hazards, event return time. Geological resources and their management: types of resources, use and potential environmental conflict, resource economics and policy formulation. Waste disposal and the mineral industry, reclamation and rehabilitation of land used for extractive purposes. Swamp drainage. Geology and urban planning: map preparation, multiple land use principle, aesthetic criteria for landscape evaluation. Coastal environmental geology: sand mining, land use conflicts, off shore mining and impact of engineering works, estuarine pollution, investigation techniques. 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.

25.421G
Foundation Geology

Mechanics of failure in rock and soils. The distribution of stress beneath foundations. Geological factors in the design of building, bridge, and dam foundations. Foundations of airfield runways, and of roads. Groundwater and foundations.

Textbook

Krynine D. P. & Judd W. R. *The Principles of Engineering Geology and Geotechnics* McGraw-Hill

25.701G
Subsurface Geology and Pollution Control

Lithology of main rock types involved in subsurface waste disposal; mass properties of rocks affecting fluid flow, porosity, permeability, capillarity and their inter-relationships. Elements of structural geology, stratification, lenticularity, folding, faulting, unconformities; use of structural contours in subsurface geology; interpretation of simple geological maps. Hydrostatic and hydrodynamic conditions in subsurface flow of liquids and gases; reservoir engineering topics, compressibility, rock pressure. Design and cementation of casing strings; importance of preservation of subsurface waters, especially fresh water aquifers; rational exploitation of subsurface water for domestic and industrial use. Technology of subsurface disposal of wastes—liquid, gaseous and solid, including radioactive wastes. Some ethical considerations and statutory requirements of governmental bodies. Investigation of sedimentary basins and individual structures for waste injection. Case histories, eg, Rocky Mountain Arsenal Well.

School of Geography

Undergraduate Study

27.001
Applied Physical Geography L2T4

Introduces the physical basis of geography. Principles of meteorology. Climatic types and world climate patterns. Hydrologic cycle and water balance. Geologic and climatic factors in landforms and soils. Mass movement and slope form, river action and valley features. Concepts of landscape evolution. Coastal processes and forms. Soil properties, classes and distribution. Soils in the landscape. Spatial organization of plants and animals over the earth's surface and the processes underlying their organization. Characterization of plant communities and ecosystems. Composition, structure, dynamics and classification of vegetation and ecosystems. Vegetation dynamics and patterns. Land systems illustrating the interaction of physical and biological factors. Man as a geographic agent. Weather recording and analysis of climatic data. Use of maps and air-photos. Elementary map-making. Methods of describing soils, vegetation and land systems.

The course includes three compulsory one-day field excursions equivalent to twenty-four tutorial hours.

Textbooks

Bridges E. M. *World Soils* C.U.P.*
Corbett J. R. *The Living Soil* Martindale
Miller A. *Meteorology* Merrill*
Twidale C. R. *Geomorphology* Nelson*
Whittaker R. H. *Communities and Ecosystems* Macmillan*

27.011
Applied Economic Geography I L2T4

Part 1. (Session 1): Basic concepts and approaches employed in the study of space economy. Spatial interaction and the analysis of movement patterns; location, land use, rent theory and comparative advantage; location of manufacturing; location of service activities and the central place system; spatial aspects of economic growth and development. Australian case studies are stressed. Laboratory classes deal with acquisition and handling of data.

Textbook

Hurst M. E. *A Geography of Economic Behaviour* Duxbury

Part 2. (Session 2): The role of urban areas as focal points in the structure and organization of the space economy. The spatial structure and growth of urban networks and the internal characteristics of urban areas. Topics include: urbanization in developed and underdeveloped economies; the urban growth process; location, size and spacing of urban areas; the internal structure of cities; an economic analysis of urban problems. Laboratory classes deal with statistical methods in economic geography.

27.002
Applied Economic Geography II L2T4

Classical and more recent adaptations of location theory, in particular those of Weber, Greenhut, Losch and Isard; spatial price theory and the location of the firm. Methods of location analysis: comparative cost analysis, input-output, spatial interaction models, linear programming, resource assessment in economic terms. Location policies and problems in differing economic systems.

Textbook

Wilson A. G. *Urban Regional Models in Geography* Wiley

27.013
Advanced Methods in Economic Geography

Student projects based on instruction in research design, data sources, field methods; collection, classification and analysis of data. Mathematical background to regression, multivariate techniques and linear models. Laboratory work includes use of CYBER and HP 30 digitizer and plotter.

27.003
Applied Economic Geography III L2T3/4

Models of urban economic structure; the structural growth of cities with particular consideration given to residential location and urban renewal. Cost-benefit analysis. Urban transportation problems and planning. Urban poverty and public policy. Urban public finance and the distribution of urban functions in multi-level government; urban revenue sources. Public finance in relation to resource allocation and growth. The course deals exclusively with Australia.

Textbooks

Aigner D. J. *Basic Econometrics* Prentice-Hall
Edwards P. *Flowcharting and FORTRAN IV* McGraw-Hill
King L. J. *Statistical Analysis in Geography* Prentice-Hall.
Nie N. H. *et al Statistical Package for the Social Sciences* McGraw-Hill*
Sterling T. D. & Pollock S. V. *Introduction to Statistical Data Processing* Prentice-Hall
Kerlinger R. *Foundations of Social Research* Holt Rinehart & Winston

27.014
Advanced Methods in Physical Geography L1T1½

Student projects based upon instruction in research design, data sources, field methods, collection, classification and analysis of data. Includes a mathematical background to regression, multivariate techniques, linear models. Laboratory work includes use of CYBER and HP 30 digitizer and plotter.

Textbook

King L. J. *Statistical Analysis in Geography* Prentice-Hall

27.023
Population Geography L2T3/4

Population growth and contrasts in growth patterns between underdeveloped, modernizing and developed countries. Growth dynamics and their relation to physical and human resources. The demographic transition as a unifying theme. Population densities in urban and rural areas: case studies are drawn mainly from Western Europe, Southeast Asia and Australia. Social and economic factors in international and internal migration. Spatial interaction between the populations of rural areas and cities, and between cities. Fertility and mortality variations within and between regions, countries and cities. Urbanization of population. Stable and stationary population theory. World population problems. Workshop tutorials are concerned with session projects.

Textbooks

Demko E. J. Rose H. M. & Schnell G. A. *Population Geography: A Reader* McGraw-Hill*
Wilson M. G. A. *Population Geography* Nelson*
Zelinsky W. Kosinski L. A. & Mansell Prothero R. *Geography and a Crowding World* OUP

27.103
Climatology L2T3½

Components of the radiation and heat balance of the earth surface as affected by differing atmospheric, soil and surface cover conditions. Factors controlling evaporation and transpiration under freely-available

* Paperback.

and restricted water supply conditions, and methods for the measurement and estimation of evapotranspiration. Characteristic patterns of energy and water exchange for differing types of natural or man-modified land surface. Man's modification of factors affecting the local climate in rural and urban settings.

Laboratory work is directed toward developing an appreciation of the operational principles and limitations of instruments commonly used in radiation and water balance studies. An introduction is given to the practical application of energy and water balance models for evaluation of the climatic environment as related to catchment hydrology, agricultural productivity and land resource management problems.

Textbook

Sellers W. D. *Physical Climatology* Chicago UP

27.104
Bioclimatology L2T3½

Energy exchange between organism and environment in typical habitats of distinctive plant communities. Characteristics of water balance components as related to plant community attributes and meteorological factors. Wind profiles and aerodynamic characteristics as affected by height, density and structure of plant communities. The soil microclimate: thermal and moisture characteristics, soil aeration properties; their relation with biological processes. Periodic biological phenomena as related to climate (phenology), and climatic factors in the migration of organisms and the transport of insects, spores and pathogens. Models for assessment of plant growth and development. Climate as related to human physiology and comfort.

Laboratory work consists of measurements and observations of the aerial and soil microclimate and interpretation of environmental data for purposes of bioclimatic assessment and classification.

27.113
Urban Geography L2T3/4

The geography of cities in the context of economic and cultural systems, social and political processes, and historical perspectives. Foundations of urban geography; the city in under-developed countries and planned economies; the city as an eco-system; distributions; problems and policies of urban size; growth centres and urban planning; inter-urban and intraurban movement and linkages; urban residential preferences and spatial differentiation; urban environmental quality and the perceived urban environment. Weekly seminars, and laboratory and field work of a practical nature to include urban survey techniques.

27.123
Social Geography† L2T3/4

The relationship of spatial and social structures in rural and urban contexts. Emphasis on social processes producing spatial patterns, with themes such as 'community', 'neighbourhood', urbanization, social deprivation, inequality and segregation of minorities, and the results of social area studies. Cultural influences in the rate and form of urbanization. Rurality and urbanism as ways of life. Relation of overseas experience to Australian society.

Laboratory sessions include census data handling, questionnaire construction, interviewing, participant observation and other unobtrusive techniques.

27.124
Geographic Thought and Perspectives L1T2

A series of seminars throughout the year on the development of geographic thought and ideas. In Session 1 the seminars are concerned with topics related to students' projects, while in Session 2 the major geographic traditions and emergent theories related to students' special interests are discussed.

27.203
Biogeography L2T3½

Ecosystems, their structure and dynamics. Energy flow and biogeochemical cycles. Comparative photosynthetic capacity of plants. Productivity, exploitation, pollution, management and conservation of ecosystems. Man as an ecological agent.

Quantitative sampling, measurement and description of vegetation. Spatial distribution (pattern) of individual species. Association between species.

Ecology of tropical and sub-tropical regions with special reference to Australia. Floristic composition, structure and physiognomy of the principle vegetation formations of Australia (rain forest, woodland, shrubland, heath and grasslands). Geographical affinities of component species. Environmental and biotic controls. Adaptations of plants to humid and arid conditions. Vegetation management under humid and arid conditions.

Fieldwork forms an integral part of the course.

Textbooks

Kershaw K. A. *Quantitative and Dynamic Plant Ecology* 2nd ed Arnold

Odum E. P. *Fundamentals of Ecology* 3rd ed Saunders

27.204
Advanced Biogeography L3T6

Taxonomic biogeography. Variation and delimitation of species. Dispersal, distribution and discontinuities of taxa. Endemic and relict species. Geological, ecological and biotic determinants of species distributions. Biotic regions and the problem of their reality and definition. Oceanic islands, evolution and biogeographic theory.

Community biogeography. Quantitative analysis of vegetation. Variation and delimitation of communities. Survey, classification, ordination and mapping of vegetation. Correlation with environment. Identification of environmental and other controls determining the distribution of vegetation and of individual component species.

Aspects of applied biogeography. Assessment and management of natural resources. Conservation of ecosystems. Use of vegetation in ground water, mineral and geological survey and exploration in Australia. Medical geography and human ecology. The role of statistics in the study and utilization of biogeographical variation and covariation.

Two field tutorials: a field project of about one week to investigate plant communities in a selected environment and a two-day excursion for comparative study of a contrasting environment.

Textbooks

Good R. *The Geography of the Flowering Plants* 3rd ed Longman

Greig-Smith P. *Quantitative Plant Ecology* 2nd ed Butterworths

Orloci, L. *Multivariate Analysis in Vegetation Research* W. Junk The Hague

Usher M. *Biological Management and Conservation: Ecological Theory, Application, Planning* Chapman & Hall

27.303
Transportation Geography L2T3/4

The analysis of the transportation system in terms of its relationships with economic and geographic indicators. Focus on network analysis, flow studies, nodal systems, circulation theory, impact studies, transport and economic development, and the urban transportation problem.

Laboratory classes involve practical application of pertinent methodology, while seminars stress the consideration of major problem areas in transportation in Australia.

Textbook

Eliot-Hurst M. E. *Transportation Geography* McGraw-Hill*

* Paperback

† Subject to availability of staff in 1976.

27.304
Advanced Economic Geography L2T4

Approaches to the study of the space economy with emphasis on the spatial problems of economic growth and development. Problems raised are viewed from a planning perspective.

Textbooks

Richardson H.*Regional Growth Theory* Macmillan
Leven C. L. Legler J. B. & Shapiro P. *An Analytical Framework for Regional Policy* MIT Press

27.313
Location Analysis L2T4

Classical and more recent adaptations of location theory, in particular those of Weber, Greenhut, Losch and Isard; spatial price theory and the location of the firm. Methods of location analysis: comparative cost analysis, input-output, spatial interaction models, linear programming, resource assessment in economic terms. Location policies and problems in differing economic systems.

Textbook

Wilson A. G. *Urban Regional Models in Geography* Wiley

27.323
Marketing Geography L2T3/4

The relationship between consumer spatial behaviour and the pattern or structure of marketing establishments. Organization and operation of the marketing function with emphasis upon the pattern of consumer orientated enterprises and the structure of market areas in intra-urban areas. Spatial behaviour of consumers including search and decision processes. Workshop seminars on term project, analytical techniques and issues raised in lectures.

Textbooks

Engel J. F. Kollatt D. T. & Blackwell R. D. *Consumer Behaviour* Holt Rinehart & Winston
Scott P. *Geography and Retailing* Hutchinson*

27.333
Agricultural Geography L2T3/4

Physical, economic, political, and other cultural factors involved in origin and change of agricultural landscapes. Spatial patterns of agriculture as the result of individual and group decisions. Innovation diffusion as the process of farming change. Problems of agricultural modernization in South East Asia. Planning in rural areas, especially the impact on agriculture of competing land uses. Examples mainly drawn from Australasia.

Workshop/seminar classes include treatment of methods of inquiry into agricultural geographical problems and discussion of selected topics.

Textbooks

Morgan W. B. & Manton R. J. C. *Agricultural Geography* Methuen*
Powell J. M. ed *The Making of Rural Australia* Sorrett*

27.413
Geomorphology L2T2½

Advanced work in selected areas of coastal and fluvial geomorphology. The characteristics of waves in deep and shallow water. Beaches and coastal barrier systems; lagoons and estuaries. Rock platforms. Quaternary sea-level changes. Drainage basin morphometry; hill-slope geometry and hydrology. Runoff and sediment yields and their controlling factors. Variations in geomorphic processes between regions; the impact of human activity. Field projects are undertaken in both coastal and fluvial components. Laboratory time is devoted to statistical exercises using data collected from maps, airphotos and in the field.

Textbooks

Bird E. F. C. *Coasts* ANUP*
Gregory K. J. & Walling D. E. *Drainage Basin Form and Process* Arnold

27.423
Pedology L2T2½

History of Pedology. Morphological, physical and chemical properties of soil. Soil forming processes; rock weathering, silicate formation. Great Soil Groups; soil classification; soil-landscape relations and periodicity. Physical and chemical aspects of soil fertility; nutrient cycles; soil microbiology. Laboratory classes upon the measurement of soil properties; soil profile description; soil survey and mapping; analysis of soil maps. Up to five days field tutorials are an essential part of the course.

27.404
Advanced Geomorphology and Pedology L3T6

The monitoring of process and change in, and application of model studies to hillslope and fluvial environments. Absolute dating of landform and soils and determination of rates of denudation and pedogenesis. Soil erosion and its control. The history of geomorphology and pedology, and related current problems. Soil stratigraphy, mineralogy, micro-morphology and fabric analysis. Laboratory classes include the study of correlative sediments, soils, and depositional environments, soil mineralogy and soil physical properties. A field tutorial of about one week before the beginning of first session traversing geomorphic and pedologic environments in south-eastern Australia.

27.414
Advanced Geomorphology† L3T4

The history of geomorphology and the development of geomorphic thought. The application of model studies and the monitoring of process and change in hillslope, shoreline, fluvial or dune environments. Studies of correlative sediments. Absolute dating of landforms and determination of rates of denudation with special reference to Australian geochronology. Applied geomorphology. There will be supporting laboratory and tutorial classes, and a field tutorial of about one week before the beginning of first session, traversing geomorphic environments in south-eastern Australia.

27.424
Advanced Pedology† L3T4

Experimental pedology including clay mineral transformations and micromorphology. Soil physical and chemical properties; their interrelationships, including physical and chemical stability of soil aggregates, soil water and its movement, soil strength. Soil erosion and its control. Modern techniques of mapping and classifying soil; land assessment. Practical applications of soil studies to environmental problems.

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

* Paperback.

† Not offered in 1976.

systematic study which may be primarily geomorphic or pedologic, but with some interdisciplinary aspect.

To include a field element and a supporting laboratory program.

27.801
Introduction to Physical Geography L2T2½

The mechanism of the physical environment, with particular exemplification within the Sydney region. Geologic controls of landform development; fluvial, slope and coastal processes and landforms; cyclic and equilibrium approaches to landform studies. The global radiation budget and atmospheric circulation; weather and climatic controls in the Sydney region. The hydrologic cycle. Processes and factors of soil formation and the mature soil profile. Controls of vegetation in the Sydney region. The ecosystem.

Laboratory classes include: study and use of geologic and topographic maps and air photographs; use of climatic data and the weather map; soil profile description. Two field tutorials, equivalent to 16 tutorial hours, are a compulsory part of the course.

Textbook

Van Riper J. E. *Man's Physical World* McGraw-Hill

27.862
Australian Environment and Land Resources L2T3

Regional patterns of natural land resources of Australia. Climatic, geomorphic, soil and biotic factors affecting past, present and potential modes of land use and stability of primary production. Physical environmental conditions favouring or impeding productive utilization and further development of land resources under a changing technology. Problems of avoiding degradation of land quality and natural ecosystems. Case studies from distinctive environmental settings in Australia.

Laboratory/workshop sessions include study of maps and airphotos of typical environments.

Textbook

CSIRO *The Australian Environment* MUP

Graduate Study

27.901G
Geomorphology for Hydrologists 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 analyses of drainage features and map and field study of a vigil catchment.

Textbooks

Gregory K. J. & Walling D. E. *Drainage Basin Form and Process* Arnold

Leopold L. B. Wolman M. G. & Miller J. P. *Fluvial Processes in Geomorphology* Freeman

Morisawa M. *Streams* McGraw-Hill*

27.902G
Meteorological and Hydrological Principles 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 stream velocity characteristics, tidal estuaries, ocean currents. Dispersal of pollutants in flowing water.

27.904G
Geomorphology for Engineering Geologists 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.

Textbooks

Mitchell C. *Terrain Evaluation* Longman

Thornbury W. D. *Principles of Geomorphology* Wiley

School of Marketing

Undergraduate Study

28.012
Marketing Systems

Marketing from various perspectives. Marketing as an economic and social phenomenon, a management discipline and a 'science'. The respective roles of products, prices, promotion and distribution in effecting economic exchange.

Textbook

Gist R. R. *Marketing and Society* 2nd ed Holt Rinehart & Winston

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.

Textbook

King W. R. *Quantitative Analysis for Marketing Management* McGraw-Hill

28.032
Behavioural Science

Major concepts and research in the behavioural sciences which reveal the dynamics of human behaviour and the variety of viewpoints that can

* Paperback.

be adopted in explaining behaviour. The nature and scope of behavioural science; concepts of man in psychology and sociology; culture; social institutions; groups; social class; interpersonal and mass media communication; learning; perception; personality.

Textbooks

Broom L. & Selznick K. *Sociology: A Text with Adapted Reading* 5th ed Harper & Row
Fabun D. *Communications: The Transfer of Meaning* Glencoe
Kassarjian H. H. & Robertson T. S. eds *Perspectives in Consumer Behaviour* Scott Foresman

28.042
Consumer Behaviour

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: proximal and distal environmental inputs; motivation and arousal; consumer behaviour as a decision process; problem recognition; search behaviour; choice behaviour; purchasing processes; post-purchase behaviour.

Textbooks

Engel J. F. Kollat D. T. & Blackwell, T. S. *Consumer Behaviour* Holt Rinehart & Winston
Kassarjian H. H. & Robertson T. S. eds *Perspectives in Consumer Behaviour* Rev ed Scott Foresman

School of Surveying

Undergraduate Study

29.441
Engineering Surveying

Part A. Ordinary levelling. Angle measurement. Linear measurement (bands). Theodolite traversing. Tacheometry. Contour and detail surveys. Areas and volumes.

Part B: Levelling (other methods). Linear measurement (electronic). Applications of survey techniques: control surveys, provision of information for design, setting out, engineering works, etc. Outline of photogrammetry.

Textbooks

Bannister A. & Raymond S. *Surveying* Pitman*
Seven Figure Mathematical Tables Chambers 1958 (full edition)

29.491
Survey Camp

A one-week field camp for students studying 29.441 Engineering Surveying.

School of Town Planning

Undergraduate Study

36.411
Town Planning

The urban planning process. The industrial and urban revolution. Regional planning concepts. Housing and new towns. Civic design. Human environment. Social planning: societal values and societal organization. Social planning: public participation, quality of life. Planning law and administration. Levels of planning and types of plans. Ecological land use planning. Uses of the Lowry Model. Metropolitan planning concepts with particular application to Sydney and Canberra. Neighbourhood planning. The future city.

School of Biochemistry

Undergraduate Study

41.101A
Chemistry of Biologically Important Molecules

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. Practical work to amplify the lecture course.

Textbook

Stryer L. *Biochemistry* Freeman

41.101B
Metabolism

The intermediary metabolism of carbohydrates, lipids and nitrogenous compounds. The molecular mechanism of gene expression and protein synthesis. Photosynthesis. Practical work to amplify the lecture course.

Textbook

As for 41.101A.

41.101C
Control Mechanisms

The relation between structure and function of enzymes, hormones, vitamins and membranes. Metabolic networks and control mechanisms. Practical work to amplify the lecture course.

Textbooks

As for 41.101A, plus
White A. Handler R. & Smith E. L. *Principles of Biochemistry* 5th ed McGraw-Hill

* Paperback.

41.102A
Biochemistry of Macromolecules and Cell Biochemistry

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. Membrane structure. Cellular degradation. Practical work to illustrate the lecture course and to provide experience in modern biochemical techniques.

Textbooks

Scientific American *The Chemical Basis of Life. An Introduction to Molecular and Cell Biology* Freeman
White A. Handler R. & Smith E. L. *Principles of Biochemistry* 5th ed McGraw-Hill

41.102B
Metabolic Pathways and Control Mechanisms

Haemoproteins, and electron transport, photosynthesis, photophosphorylation and oxidative phosphorylation. The nature and function of co-enzymes. Inter-relationships in mammalian intermediary metabolism. Biochemical control mechanisms including hormones and allosteric interactions. Enzyme kinetics. Selected aspects of differentiation and development in higher organisms. Practical work to illustrate the lecture course and to provide experience in modern biochemical techniques.

Textbooks

As for 41.102A.

School of Biological Technology

Undergraduate Study

42.102
Fermentation Technology

The basic factors involved in the operation of microbial processes on an industrial scale, including: the selection, maintenance and improvement of micro-organisms; the influence of physical and chemical factors on the microbial environment; the control of environmental factors; the effects of operational patterns in batch and continuous flow cultivation; the harvesting, purification and standardization of products; process optimization; disposal of waste materials; an examination of selected microbial processes for chemical, pharmaceutical and food production, against the basic characteristics of large-scale fermentation processes; practical exercises, including the operation of various types of fermenters, to illustrate the principal aspects of the lecture course.

Textbooks

Aiba S. Humphrey A. E. & Millis N. *Biochemical Engineering* 2nd ed Academic
Casida L. E. Jr *Industrial Microbiology* Wiley
Kubitschek, H. E. *Introduction to Research with Continuous Cultures* Prentice-Hall

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.

Textbook

Villee C. A. *Biology* 6th ed Saunders

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.

Textbook

Conn E. E. & Stumpf P. K. *Outlines of Biochemistry* 3rd ed Wiley

42.213G
Biochemical Methods

A laboratory program in practical biochemistry. The basic instrumentation and methodology of the biochemist will be introduced by practical exercises and demonstrations. A comprehensive treatment of the relevance and applicability of biochemical techniques will be covered in tutorials.

Textbook

Montgomery R. & Swenson C. A. *Quantitative Problems in the Biochemical Sciences* Freeman

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 will be selected from: antibiotic and enzyme production, alcoholic beverages, single cell protein (SCP), microbial waste disposal and bacterial leaching.

Tutorial/practical sessions include: problem solving, instrumentation, continuous culture techniques, and mathematical modelling and simulation of industrial processes.

Textbooks

Aiba S. Humphrey A. E. & Millis N. *Biochemical Engineering* Academic
Casida L. E. Jr *Industrial Microbiology* Wiley
Kubitschek H. E. *Introduction to Research with Continuous Cultures* Prentice-Hall

School of Botany

Undergraduate Study

43.101
Genetics

Various aspects of molecular, organismal and population genetics, including: meiotic and non-meiotic recombination, genome varations, 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.

Textbook

Patt D. I. & Patt G. R. *An Introduction to Modern Genetics* Addison-Wesley

43.111
Flowering Plants

The vegetative and floral morphology of Angiosperms with special reference to variations in morphology, evolutionary trends, elements of biological classification, nomenclature and identification of native plants. Field work is part of the course.

Textbooks

Beadle N. C. W. Evans O. D. & Carolin R. C. *Flora of the Sydney Region* Reed
Esau K. *The Anatomy of Seed Plants* Wiley

43.112
Plant Taxonomy

The assessment, analysis and presentation of data for classifying plants both at the specific andd supra-specific level; with emphasis on vascular plants. Field work is part of the course.

Textbooks

Beadle N. C. W. Carolin R. C. & Evans O. D. *Handbook of the Vascular Plants of the Sydney District and Blue Mountains*
Jeffrey C. *An Introduction to Plant Taxonomy* Churchill
Jeffrey C. *Biological Nomenclature* Arnold
Sporne K. R. *The Morphology of the Gymnosperms* Hutchinson

43.121
Plant Physiology

The physiology of the whole plant: photosynthesis, the role of phytochrome in plant morphogenesis and flowering, inorganic nutrition transport, translocation, physiology of growth and development, seed physiology and plant growth substances and their application in agriculture.

Textbooks

Galston A. W. & Davies P. J. *Control Mechanisms in Plant Development* Prentice-Hall
Richardson M. *Translocation in Plants* Arnold
Sutcliffe J. *Plants and Water* Arnold
Whittingham C. P. *Photosynthesis* OUP

43.142
Environmental Botany

The marine, 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 up to three full-day Saturday field excursions as part of the practical course.

School of Microbiology

Undergraduate Study

44.111
Microbiology

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 course for those who do not wish to take further courses in microbiology and who may have less biological and biochemical background than is required for other microbiology courses.

Textbooks

Brock T. D. *Biology of Microorganisms* Prentice-Hall
or
Mitchell, R. Introduction to Environmental Microbiology
or
Pelczar M. J. & Reid R. D. *Microbiology* 3rd ed McGraw-Hill

44.141
Introductory Microbiology for Food Technologists

Prerequisites: 17.011 and 17.021.

The general nature, occurrence and importance of microorganisms. A short 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 bacterial-like forms); viruses. Microbial growth and physiology. Principles of sterilization and disinfection. Groups of bacteria of importance in the food industry. Bacterial endospores. Industrial uses of microorganisms. Microbial food spoilage. Food intoxications and infections. Microbial ecology.

Textbooks

Brock T. D. *Biology of Microorganisms* Prentice-Hall
or
Stanier R. Y. Doudoroff M. & Adelberg E. A. *General Microbiology* 3rd ed Macmillan (also published as *The Microbial World* 3rd ed Prentice-Hall
or
Hawker L. E. & Linton A. H. eds *Micro-organisms: Function, Form and Environment* Arnold

44.142
Microbiology for Food Technologists

Prerequisite: 44.141.

A laboratory course of six hours per week (Session 1), covering the following topics: microscopy, choice and preparation of media, application of aseptic techniques, quantification of microbiological growth, isolation and identification of micro-organisms important to food processing. Principles of sterilization, heat resistance of vegetative cells and spores, food spoilage, food-borne organisms.

Assessment is continuous and grading is based upon the number of objectives achieved.

Textbooks

No set texts, but specific reading assignments are given.

School of Sociology

Undergraduate Study

53.101
Sociology 1A

An introduction to sociology, with particular reference to the history and development of social thought. Students are required to read basic texts and to submit related written work.

53.102
Sociology 1B

An introduction to the institutions, processes and belief systems of modern industrial society, with special emphasis on Australia; reading and written work related to basic texts; and an introduction to research methods in the social sciences.

53.206
Science, Technology and Society

The attention of students is drawn to the course on "Science, Technology and Society" given in the School of Sociology. Details of this course are given in the Faculty of Arts Handbook. This course may be taken as an alternative to an advanced elective in General Studies, with the permission of the Head of the School of Sociology. Interested students should apply to the School of Sociology before the beginning of Session 1.

School of Education

58.061
Methods of Teaching I

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

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.

58.512
Introduction to Education

An examination of the view commonly held by prospective teachers that their task in the classroom will be simply to teach specific subject matter. Some of the difficulties encountered in the communication of ideas to pupils, developing a broader view of the educational process. Psychological, philosophical and sociological perspectives of the teaching-learning situation.

The subject serves as a basis for study in greater depth of educational psychology, philosophy and theory of education and sociology of education in succeeding years and shows the contribution of each to the practice of teaching. Lectures and seminars are closely related to a series of school visits extending throughout the year.

58.513
Education IA

Educational Psychology: Learning, motivation, child and adolescent development, group processes, personality and other psychological factors related to learning and instruction. *Philosophy and Theory of Education:* Curriculum theory and curriculum development, theory in education with reference 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:* The theory and practice of research methods in education in both the parametric and non-parametric fields, including: measures of central tendency and dispersion, graphical representation of data, normal curve theory, reliability of difference between statistics, correlation, tests and examinations, analysis of variance, regression and the nature of experiments. *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

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 the classroom.

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 practical 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: The first stage in a two-stage course. *Session 1:* 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. *Session 2:* 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 II: 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.

Student's Timetable

Time	Monday		Tuesday		Wednesday		Thursday		Friday	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
9-10										
10-11										
11-12										
12-1										
1-2										
2-3										
3-4										
4-5										
5-6										
6-7										
7-8										
8-9										

1 2 3 4 5 6 7 8 9 10 11 12 13 14

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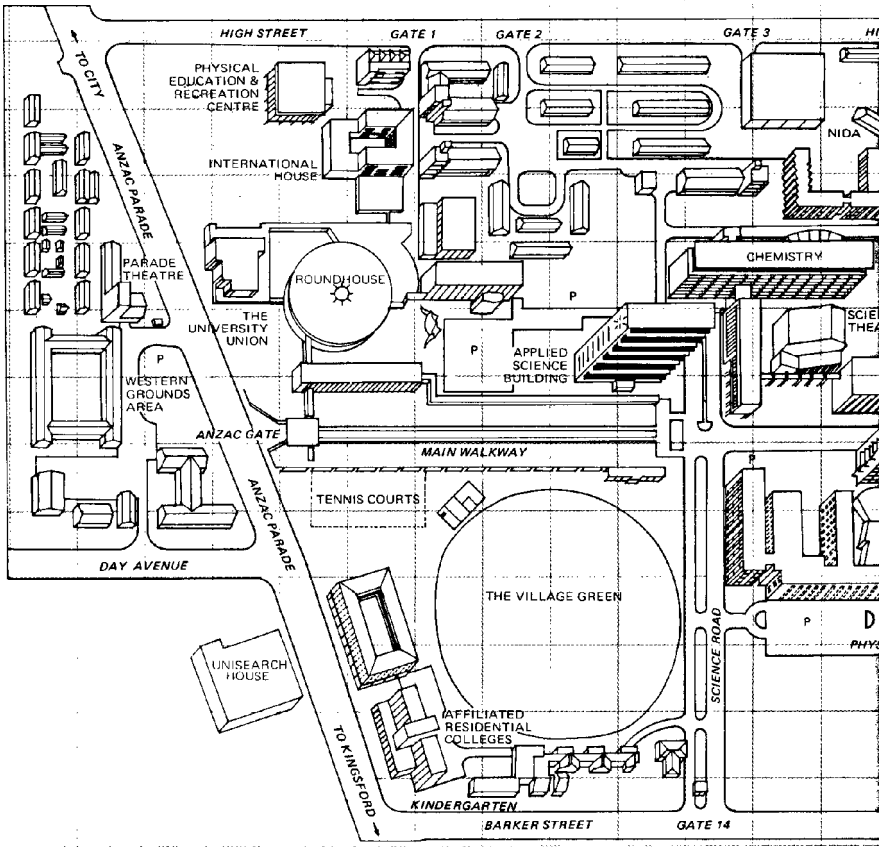

THE UNIVERSITY OF NEW SOUTH

ILDINGS

olied Science F11
hitecture H15
ks F22, F7
ser College B18
logical Sciences D26
logical Sciences Extensions E25
medical Lecture Theatres E27
tral Lecture Block E19
tral Store B13
ncellery B/C 22
ld Minding Centre N8
il Engineering H20
cknell Sports Pavilion H8
ton (Chemistry) G12
ctrical Engineering G17
ctrical Engineering
ecture Theatre F17
dstein College B/C/D16
ernational House C7
n Goodsell (Commerce) F20
th Burrows Lecture Theatre H14
nsington College C15/16/17
rary — Stage 2 F21/22
n Building J/K13/14/15/16
ntenance Workshop B13
chanical Engineering H17
dicine (Administration) B27
Menzies Library E21/22
Metallurgy E8/9
Morven Brown (Arts) C/D19/20
New College (Anglican) K/L6
Newton Building J/K12
National Institute of Dramatic Art C15
Old Main Theatrette J14
Parade Theatre and
Old Tote Theatre Company E3
Philip Baxter College D13/14/15
Physical Education and
Recreation Centre B5/6
Robert Heffron (Chemistry) E12/13
Sciences Building F23/24
Science Lecture Theatre Block D23
Science Theatre F13
Shalom College (Jewish) M9/10
Sir John Clancy Auditorium D23/24
Sir Robert Webster (Textiles) G14/15
Squash Courts B7
Union (Roundhouse) — Stage I E/F 6/7
Union (Blockhouse) — Stage II F6/7
Union (Squarehouse) — Stage III D/E5
Union (Golf House) — Subsidiary A27
Unisearch House L5
University Regiment H3
Wallace Wurth School of Medicine C26
Warrane College (Roman Catholic) M6/7
Western Campus A-J 2/3, H/J 3/4
Wool and Pastoral Sciences B8

GENERAL

Accountancy C20
Admissions Office B22
Aeronautical Engineering J/K/L18
Anatomy C26
Applied Geology F11
Applied Physics J12
Applied Science (Faculty Office) F11
Appointments Office B22
Architecture (including Faculty Office) H15
Arts (Faculty Office) D20
Biochemistry D26
Biological Sciences (Faculty Office) D26
Biological Technology D26
Biomedical Library D27
Bookshop G17
Botany D26
Building H15
Cashier's Office B22
Centre for Medical Education
Research and Development E24
Ceramic Engineering D12
Chemical Engineering F11
Chemical Technology F11
Chemistry E12/13, F/G12

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, conditions for the award of degrees, scholarships, prizes, and so on, you should consult the Calendar.

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 General Education.

The Calendar and Handbooks are available from the Cashier's Office. The Calendar costs $3 (hard cover) and $2.50 (soft cover) (plus postage and packing, 90 cents). The Handbooks vary in cost. **Applied Science, Arts, Commerce** and **Science** are $1.50: **Architecture, Engineering, Law, Medicine** and **Professional Studies** are $1.00. Postage is 40c in each case. The exception is **General Studies**, which is free.