FACULTY OF APPLIED SCIENCE

1975 HANDBOOK

THE UNIVERSITY OF NEW SOUTH WALES

$1.50

SOME PEOPLE WHO CAN HELP YOU

Note: All phone numbers below are University extension numbers. If you are dialling from outside the University dial 663 0351 and ask for the extension.

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

continued on inside back cover

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THE UNIVERSITY OF NEW SOUTH WALES
P.O. Box 1, Kensington, N.S.W. 2033
Phone: 663 0351

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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.

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Calendar of Dates for 1975

Session 1: March 3 to May 11
May Recess: May 12 to May 18
May 19 to June 15
Midyear Recess: June 16 to July 20
Session 2: July 21 to August 24
August Recess: August 25 to August 31
September 1 to November 2
Study Recess: November 3 to November 9

JANUARY

Wednesday 1	New Year's Day—Public Holiday
Friday 10	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 13	Timetables for *deferred* examinations available
Friday 17	Last day for acceptance of applications by Admissions Office for transfer to another course within the University
Monday 27	Australia Day—Public Holiday
Tuesday 28	*Deferred* examinations begin

FEBRUARY

Saturday 8	*Deferred* examinations end
Friday 14	Last day for appeal against exclusion by students who infringed re-enrolment rules at *annual* examinations
Monday 17	Enrolment period begins for new students and students repeating first year
Friday 21	*Deferred* examination results available
Monday 24	Enrolment period begins for second and later year students
Tuesday 25	Last day for application for review of *deferred* examination results
Friday 28	Last day for application for permission to re-enrol by students who infringed re-enrolment rules at *deferred* examinations

MARCH

Monday 3	**Session 1 commences**
Friday 14	Last day for acceptance of enrolments by new students (late fee payable)
Thursday 20	Last day for appeal against exclusion by students who infringed re-enrolment rules at *deferred* examinations
Thursday 27	Last day for changes in course programmes
	Last day for acceptance of enrolments by students re-enrolling in second and later years (late fee payable)
Friday 28 to Monday 31	Easter

APRIL

Thursday 3	Last day for students other than those attending a university for the first time to discontinue without failure subjects which extend over Session 1 only
Thursday 24	Last day for students attending a university for the first time to discontinue without failure subjects which extend over Session 1 only
Friday 25	Anzac Day—Public Holiday

MAY

Tuesday 6	Publication of provisional timetable for June/July examinations
Monday 12	**May Recess begins**
Tuesday 13	Last day for acceptance of corrected enrolment details forms
Friday 16	Last day for students other than those attending a university for the first time to discontinue without failure subjects which extend over the whole academic year
Sunday 18	**May Recess ends**
Monday 19	Last day for students to advise of examination timetable clashes

JUNE

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

JULY

Tuesday 1	Midyear examinations end
Sunday 20	**Midyear Recess ends**
Monday 21	**Session 2 begins**
Thursday 31	Foundation Day

AUGUST

Friday 1	Last day for students attending a university for the first time to discontinue without failure subjects which extend over the whole academic year
Thursday 21	Last day for students other than those attending a university for the first time to discontinue without failure subjects which extend over Session 2 only
Monday 25	**August Recess begins** Holiday for non-academic staff
Sunday 31	**August Recess ends** Last day for acceptance of applications for re-admission in 1976 after exclusion under the re-enrolment rules

SEPTEMBER

Friday 12	Last day for students attending a university for the first time to discontinue without failure subjects which extend over Session 2 only
Monday 15	Last day for return of corrected enrolment details forms Last day for applications from students graduating in 1976 for admission to University degrees and diplomas
Tuesday 23	Publication of provisional timetable for annual examinations

OCTOBER

Wednesday 1	Last day to apply to MUAC for transfer to another university in Sydney metropolitan area and Wollongong
Friday 3	Last day for students to advise of examination timetable clashes
Monday 6	Eight Hour Day—Public Holiday
Tuesday 21	Publication of timetable for annual examinations

NOVEMBER

Monday 3	**Study Recess begins**
Sunday 9	**Session 2 ends**
Monday 10	Annual examinations begin

DECEMBER

Tuesday 2	Annual examinations end
Thursday 25	Christmas Day—Public Holiday
Friday 26	Boxing Day—Public Holiday

1976

Session 1:	March 1 to May 9
	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
	August Recess: August 23 to August 29
	August 30 to October 31
	Study Recess: November 1 to November 7

JANUARY

Friday 9	Last date for application for review of results of annual examinations
Monday 12	Publication of timetable for deferred examinations
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
Friday 20	Results of deferred examinations available
Monday 23	Enrolment period begins for second and later year students

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 1974 the University had 17,355 students and 3,958 staff who worked in more than eighty buildings. If staff and students at Broken Hill (W. S. and L. B. Robinson University College), Wollongong (an autonomous university in 1975), Duntroon (the Faculty of Military Studies) and Jervis Bay were included there were 19,594 students and 4,522 members of staff (academic and non-academic).

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 postgraduate 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 (e.g. the School of Chemistry, the School of Mathematics, etc.). 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 are 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 advise the Chairman of the Faculty you wish to attend, as different faculties have their own rules for the conduct of open meetings.

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 programmes; 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 Schools in which you will be studying, according to the following list:

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
6	School of Electrical Engineering
7	School of Mining Engineering
8	School of Civil Engineering
9	School of Wool and Pastoral Sciences
10	School of Mathematics
11	School of Architecture
12	School of Psychology
13	School of Textile Technology
14	School of Accountancy
15	School of Economics
16	School of Health Administration
17	Biological Sciences
18	Department of Industrial Engineering
19	School of Transportation and Traffic
20	School of Highway Engineering
21	Department of Industrial Arts
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
31	School of Applied Physics and Optometry
33	Graduate School of Business
35	School of Building
36	School of Town Planning
41	School of Biochemistry
42	School of Biological Technology
43	School of Botany
44	School of Microbiology
45	School of Zoology
50	School of English
51	School of History
52	School of Philosophy
53	School of Sociology
54	School of Political Science
55	School of Librarianship
56	School of French
57	School of Drama
58	School of Education
59	School of Russian
62	School of History and Philosophy of Science
63	School of Social Work
64	School of German
65	School of Spanish and Latin American Studies
66	University of Sydney subjects
69	Centre for Medical Education, Research and Development
70	School of Anatomy
71	School of Medicine
72	School of Pathology
73	School of Physiology and Pharmacology
74	School of Surgery
75	School of Obstetrics and Gynaecology
76	School of Paediatrics
77	School of Psychiatry
79	School of Community Medicine
80	Faculty of Medicine
85	National Postgraduate School of Management Education
90	School of Law
97	Division of Postgraduate Extension Studies

In Section D of the Calendar a short syllabus is given for each subject.

Student Services and Activities

The Library The University Library is on the upper campus and adjacent to the Chancellery and the Sciences, Arts and Commerce Buildings. It contains about 650,000 books and subscribes to more than 18,000 periodicals.

Students may borrow books by presenting a current Union card and the books at the Circulation Desk. 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.

The Bio-Medical Library is located in the Biological Sciences Building. The Law Library is on the 4th Floor of the Sciences Building. A Physical Sciences Library is being developed at present in the main Library building.

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. It is anticipated that the fees in most colleges will be increased for 1975. In addition, assistance is 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. Board and residence fees, which are payable on a session basis, amount to slightly more than $30 per week. Apply in writing to the Master, P.O. Box 24, Kensington, N.S.W. 2033.

International House International House accommodates over 120 students from Australia and twenty other countries. Preference is given to more senior undergraduates and postgraduate students. Fees in 1974 were $28 per week. Apply in writing to the Warden, International House, P.O. Box 88, Kensington, N.S.W. 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. Fees in 1974 were $31 for undergraduates and $32 for postgraduate students. Fees may change in 1975. Enquiries should be addressed to the Master, New College, Anzac Parade, Kensington, N.S.W. 2033.

Shalom College Shalom College provides accommodation for 86 men and women students. The basic fee for residence in 1975 is $38 per week. 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, P.O. Box 1, Kensington, N.S.W. 2033.

Warrane College An affiliated Roman Catholic residential college, Warrane provides accommodation for 200 men students, both post-graduate and undergraduate. Basic fees in 1974 were $30.50 per week for board and residence, payable on a session basis. Apply in writing to the Master, Warrane College, P.O. Box 123, Kensington, N.S.W. 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 programme 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 postgraduate scholarships is also available.

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

Telephone 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 a.m. and 5 p.m. Monday to Friday, and 6 p.m.-9 p.m. on Tuesdays and Thursdays. Telephone extension 2679 or 3275.

Student Counselling and Research Unit The Student Counselling and Research Unit provides individual and group counselling for all students—prospective, undergraduate and postgraduate. 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.

Confidential appointments are made by dropping in to the counselling unit (Huts B and I at the foot of Basser Steps) or by telephoning extensions 2600-2605 between 9.00 a.m. and 5.00 p.m. Evening appointments are also available.

Student Amenities and Recreation Unit 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 programme 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 Inquiry 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, 3261; 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 programme for both students and staff. If you would like to take part in any of the programmes 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 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 and conducts courses in many facets of the arts including weaving, photography, creative dance and yoga.

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:

(a) 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.

(b) A casual employment service.

(c) Organization of Orientation Week.

(d) Organization of Foundation Day.

(e) A nursery/kindergarten, "The House at Pooh Corner".

(f) Publication of the student paper "Tharunka".

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.

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 $4.00.

Details of sporting facilities are available in "Action 75", 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.

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.

The University Chapel is in Hut F near the Chemistry Building, where full-time chaplains are also located. They may be contacted by phone at the following extensions: Anglican, 2684; Jewish, 3273; Roman Catholic, 2379; Churches of Christ, Methodist and Seventh Day Adventist, 2683.

University Co-operative Bookshop Limited Membership is open to all students, on payment of a fee of $5.00, 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 a.m. to 1.00 p.m. and from 2.00 p.m. to 4.30 p.m., Monday to Friday. It is open for additional periods during the first four weeks 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 663 0351, extn. 2406.

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

Air Force Squadron: The N.S.W. University Squadron has ceased to exist but students interested in the Royal Australian Air Force may apply for information to The Commanding Officer, N.S.W. Air Training Corps, 7 Hickson Road, Millers Point, N.S.W. 2000. Telephone 27 5412.

Financial Assistance to Students

Tertiary Education Assistance Scheme

The Tertiary Allowance Scheme, first introduced in 1974, has been renamed the Tertiary Education Assistance Scheme. Under this scheme assistance is available as follows:

- for full-time study in approved courses
- subject to a means test
- on a non-competitive basis
- without restriction
- to students who are not bonded
- to students who are permanent residents of Australia.

The following types of university courses will be eligible for assistance:

- Undergraduate and postgraduate degree courses
- Postgraduate 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 $6,300 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 $6,300 p.a. the amount of living allowance will be reduced by $2 for every $10 of income until the family income exceeds $12,600 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 p.a.

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 $8 per week for a dependent spouse and $5 per week for each child.

How To Apply

Two different forms are used:

1 1974 Higher School Certificate candidates will be sent forms in early January. Applications should be made immediately after enrolment.

2 All other students should apply by 31st October. Forms will be sent in September to students who have been receiving an allowance. Other students may obtain forms from the Admissions Section or the Student Employment and Scholarships Unit, or from the Regional Director, N.S.W. State Office, Department of Education, Central Square, 323 Castlereagh Street, Sydney, N.S.W. 2000 (Telephone 2 0929).

Scholarships, Cadetships

1 *Undergraduate Scholarships* In addition to finance provided under the Australian Government's Tertiary Education Assistance Scheme there are a number of scholarships, cadetships and other forms of assistance available to undergraduate students.
Details of procedures for application for these awards are contained in the University Calendar.
Further information and advice regarding scholarships is available from the Student Employment and Scholarships Unit in the Chancellery Building.

2 *Postgraduate Awards* An honours degree is generally an essential requirement for gaining one of the many postgraduate 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 postgraduate awards are contained in the University Calendar.

Other Financial Assistance

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

(a) The Students' Union and the University have co-operated to provide assistance to students who are in financial difficulties which are considered likely to prejudice their studies.

Three main 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.

In exceptional circumstances the University may consider granting deferments for up to twelve months or even longer. In cases where payment is deferred to 31st December, examination results will not be published or made available until such time as the outstanding fees are paid. Where deferments are granted to a date beyond 31st December, the University may require the student to enter into a formal agreement to repay the fees.

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 *Long Term Cash Loans* An amount of up to $300 is available from this fund. Repayments must be started not later than twelve months after graduation or upon withdrawal from the course. This scheme is funded jointly by the University and the Students' Union. Students are required to enter into a formal agreement with the University to repay such a loan.

(b) 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 twelve months 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 of funds as mentioned in the preceding paragraph students who are in extremely difficult financial circumstances may apply for assistance by way of non-repayable grant. In order to qualify for a grant a student must generally show that the financial difficulty has arisen from misfortune beyond his control.

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

Applications may be made personally to the Deputy Registrar (Student Services), Room 148A, 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 enquiries relating to this scheme should be directed to the Deputy Registrar (Student Services), Room 148A, 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 University Calendar.

When and where do I enrol? To effect formal enrolment it is necessary to present a duly completed and authorized enrolment form to the University cashier together with, where payable, either the appropriate fees, or an authority authorizing those fees to be charged to some other person or institution.
All students are required to attend the appropriate enrolment centre during the prescribed enrolment period for authorization of course programme. Failure to do so will incur a fee of $10. These enrolment centres and the times are listed in a leaflet called "Enrolment Procedures" which is available from the Admissions Office.
Fees should be paid during the prescribed enrolment period but will be accepted during the first two weeks of Session 1 (for late fees see below). No student is regarded as having completed enrolment until fees have been paid. Fees will not be accepted (i.e. enrolment cannot be completed) from new students in year-long courses after 14th March, 1975, and after 31st March from students who are re-enrolling, except with the express approval of the Registrar, which will be given in exceptional circumstances only.
Students enrolling for the first time in any year at the commencement of Session 2 for Session 2 courses only are required to pay all fees due within the first two weeks of that Session. Students' Activities fees payable will be half of the annual fees.

Medical Students

Although the structure of the academic year in the later years of the course in Medicine differs from that followed in other courses, medical students are required to observe the same dates for payment as apply to students in other courses.

How do assisted students (e.g. 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. If this voucher or letter is not available when enrolling they should complete their enrolment paying their own fees. A refund of fees will be made when the enrolment voucher or letter of authority is subsequently lodged with the Cashier.

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.

Your application must give year or stage, whether full-time or part-time, and the course in which you wish to enrol. State clearly and fully the reasons why payment cannot be made and the extension is sought and lodge your application before the date on which a late fee becomes payable. Normally the maximum extension of time for the payment of fees is one month for fees due in Session 1 and one month from the date on which a late fee becomes payable in Session 2.

If an extension of time is granted to a first year student in Session 1 the student may only attend classes on the written authority of the Registrar. This authority will not normally be given in relation to any course where enrolments are restricted.

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.

You will not be eligible to attend the annual examinations in any subject if any portion of your fees for the year is outstanding after the end of the fourth week of Session 2 (15th August, 1975).

In very special cases the Registrar may grant exemption from disqualifications referred to in the two preceding paragraphs 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 17th 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 programme? If you wish to seek approval to substitute one subject for another, add one or more subjects to your programme or discontinue part or all of your programme, 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 31st March.

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: one calendar month from the beginning 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 17th January of the same year that 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 the end of 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. They apply to all students other than those enrolled in programmes leading to a higher degree or diploma. It should be noted that these rules are independent of one another in that a student may infringe more than one rule simultaneously. A subject is defined as a unit of instruction identified by a distinctive subject number. At present the Appeal Committee referred to in Rule 8 consists of a Pro-Vice-Chancellor (Chairman), the Chairman of the Professorial Board, and the Member of Council elected by the graduates of the University. The Pro-Vice-Chancellor is Professor J. B. Thornton.

First-year Rule

1 i A student enrolled in the first year or first stage of any course, other than course 380, the Medical (MB BS) degree course, shall be required to show cause why he should be allowed to continue the course if he fails more than half the subjects in that year or stage.

ii A student enrolled in the first year of course 380, the Medical (MB BS) degree course, shall be required to show cause why he should be allowed to continue the course if he fails more than two subjects in that year.

iii The provisions of paragraphs (i) and (ii) shall be deemed to apply to a student enrolled in the second or later year or the second or later stage of any course who has transferred from another course or institution and who, in the first year of enrolment immediately following transfer, is enrolled in subjects so chosen that half or more are listed in the current University Calendar as first-year subjects.

Repeated-failure Rule

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

Time Rule—Completion of Years or Stages

3 i A full-time student in either course 340, the Arts (BA) degree course, or 403, the Social Work (BSW) degree course, shall be required to show cause why he should be allowed to continue the course if he is unable to complete eight one-session subjects (or the equivalent) by the end of his second year of attendance.

ii Unless the provisions of paragraph (i) apply, a full-time student shall be required to show cause why he should be allowed to continue a course if he is unable to complete all subjects in the first year of the course by the end of his second year of attendance.

iii A student in course 380, the Medical (MB BS) degree course, shall be required to show cause why he should be allowed to continue the course if he is unable to complete all subjects in the second year of the course by the end of his third year of attendance and the third year by the end of his fourth year.

iv A part-time student in course 397, the Science (BSc) degree course, shall be required to show cause why he should be allowed to continue the course if he is unable to complete eight level-one units, including two in mathematics, by the end of his fourth year of attendance and fourteen units, including at least three at level two, by the end of his seventh year.

v Unless the provisions of paragraph (iv) apply, a part-time student shall be required to show cause why he should be allowed to continue a course if he is unable to complete all subjects in the first two stages of the course by the end of his fourth year of attendance and the third and fourth stages by the end of his seventh year.

Time Rule—Completion of Course

4 A student shall be required to show cause why he should be allowed to continue a course which he is unable to complete in the time set down in the following schedule:

Number of years in course	Total years allowed from first enrolment to completion
3	5
4	6

5	8
6	9
7	11
8	12
9	14

Continuation Rule

5 i A student enrolled in a course who has transferred with a record of failure from another tertiary institution shall be required to show cause why he should be allowed to continue the course if he fails more than half the subjects in his first year of enrolment immediately following transfer.

ii A student excluded from a course under the provisions of the Rules who has subsequently been allowed to re-enrol in that course or to transfer to another course shall show cause why he should be allowed to continue the course if he fails one or more subjects in his first year of re-enrolment or transfer.

General Exclusion Rule

6 The Vice-Chancellor may, on the recommendation of the Re-enrolment Committee of the Professorial Board, exclude from a course or courses any student who has been excluded from any other course under the provisions of the Rules and whose record at the University demonstrates the student's lack of fitness to pursue such course or courses.

'Showing Cause'

7 i 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 should be lodged with the Registrar.

ii Any such application shall be considered by the Re-enrolment Committee which shall determine whether the cause shown is adequate to justify the student's being allowed to re-enrol.

Appeal

8 i 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 the Appeal Committee constituted by Council for this purpose. The decision of the Appeal Committee shall be final. In lodging such appeal with the Registrar the student should ensure that a complete statement is furnished of all grounds on which the appeal is based.

ii The notification to any student of a decision by the Re-enrolment Committee to exclude him from re-enrolling in a course and/or subject(s) shall indicate that the student may appeal against that decision to the Appeal Committee.

iii The Appeal Committee shall determine the appeal after consideration of the student's academic record and the stated grounds. In exceptional circumstances the Appeal Committee may require the student to appear in person.

Exclusion

9 i A student who is required to 'show cause' under the provisions of Rule 1 and either does not attempt to 'show cause' or whose application for special permission to re-enrol does not satisfy the Re-enrolment Committee (or the Appeal Committee on appeal) shall be excluded from re-enrolling in the subject(s) and course on account of which he was required to 'show cause'. Where the subjects are a prescribed part of any other course (or courses) he shall not be allowed to enrol in that course (or courses).

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

iii A student who is required to 'show cause' under one or more of Rules 3-5 and either does not attempt to 'show cause' or whose application for special permission to re-enrol does not satisfy the Re-enrolment Committee (or the Appeal Committee on appeal) shall be excluded from re-enrolling in the course on account of which he was required to 'show cause'.

iv A student excluded from a course under the provisions of any one or more of paragraphs (i)-(iii) may not enrol in miscellaneous subjects unless he has received the approval of the Admissions Committee of the Professorial Board.

Re-admission after Exclusion

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

ii An excluded student who intends applying for re-admission at a future date may seek advice as to ways in which he may enhance his prospects of re-admission. Such enquiries should be made on the form available from the Examinations and Student Records Section and should be lodged with the Registrar.

iii 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 31st August in the year prior to that for which re-admission is sought. A late application will only be accepted at the discretion of the University.

iv An application should include:

(a) evidence of appropriate study in the subject(s) (or the equivalent) on account of which the applicant was excluded, and

(b) 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.

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 12th September, in a student's final year. 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 programme, must be submitted in writing to the Registrar no later than 30th January.

Fees*

Do I have to pay fees for tuition? No. On 1st January, 1974, fees for tuition were abolished. Other fees and charges remain 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. Late fees are charged where a student fails to observe required procedures by the appropriate time. 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 and 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 undergraduate students and students taking miscel-

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

laneous subjects (with the exception of External Students) will be required to pay:

University Union†—$20 entrance fee

Student Activities Fees

University Union†—$30 annual subscription
Sports Association†—$4 annual subscription
Students' Union†

Students enrolling in full-time courses—$10 annual subscription
Students enrolling in part-time courses—$8 annual subscription

Miscellaneous—$17 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.)

Where applicable, students will also be required to pay $10 for the Pathology Instrument Kit, refundable on return in satisfactory condition.

The Deputy Registrar (Student Services) may, on application, waive student fees for students who, while enrolled in a degree or diploma course at another University in New South Wales, are given approval to enrol at the University of New South Wales in miscellaneous subjects which will be acceptable for credit towards the degrees or diplomas for which they are enrolled.

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

† Life members of these bodies are exempt from the appropriate fee or fees.

What penalties exist for late payment of fees? The following additional charges will be made in 1975 when fees are paid late:

Session 1—First Enrolments

Fees paid on the late enrolment date, 28th February or later but before 3rd March	$10
Fees paid between 3rd and 14th March	$20
Fees paid after 14th March with the express approval of the Deputy Registrar (Student Services) and Head of the School concerned	$40

Session 1—Re-enrolments

Failure to attend enrolment centre during enrolment week 24th to 28th February	$10
Fees paid between 17th and 31st March	$20
Fees paid after 31st March where accepted with the express approval of the Deputy Registrar (Student Services)	$40

Session 2—All Enrolments

Fees paid between 4th and 11th August	$20
Fees paid thereafter	$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 a refund of all fees paid will be made. After that time only a partial refund will be made.

Examinations

When are examinations held? Most annual examinations are held in November-December but examinations in many subjects are also held during the mid-year 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 Wallace Wurth Medical School, Biological Sciences Building, the Chancellery, Central Lecture Block, Dalton Building (Chemistry), Main Building (Mining and Physics), outside the Sciences Building and in the Western Grounds Area on 6th May and 23rd September. You must advise the Examinations Unit (Chancellery) of a clash in examinations by 19th May and 3rd October. Final timetables are displayed and individual copies are available for students on 3rd June and 21st 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 pre-requisite. 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 30th November) or to your vacation address (fill in a form obtainable at the Enquiry Desk, Chancellery, also by 30th November). Results are also posted on School noticeboards 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, 1974	Friday, 10th January, 1975
Deferred examinations held in January/February, 1975	Tuesday, 25th February, 1975
Annual examinations held in November/December, 1975	Friday, 9th January, 1976
Deferred examinations held in January/February, 1976	Tuesday, 24th February, 1976

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 *at an examination* 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, 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.

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.

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 Section A of the University 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 Enquiry 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, beyond prohibiting gambling on the campus and smoking during lectures, at examinations or in the library.

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 conduct yourself at all times in a seemly fashion.

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 programme 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 at the University Union Enquiry Desk as soon as possible after fee payment. In the meantime, the fees receipt form should be carried during attendance at the University and shown on request. A period of at least three weeks should be allowed to elapse after payment of fees before making application for the card. Cards will not be posted under any circumstances.

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 not reaching you. The University cannot accept responsibility if official communications fail to reach students who have not notified their change of address. A Change of Address Advice Form is available at Faculty and School offices and at the Enquiry Counters on the Ground Floor of the Chancellery Building.

How are student records kept up to date? All students will receive enrolment details forms by 29th April and 1st September. It is not necessary to return these forms unless any information recorded thereon is incorrect. Amended forms must be returned to the Examinations and Student Records Section by 13th May and 15th September respectively. Amendments notified after the closing date will not be accepted unless exceptional circumstances exist and approval is obtained from the Registrar. Where a late amendment is accepted, a late fee of $8 will be payable. 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); higher degree students (limited issue, annual fee $7.80);

postgraduate, and senior undergraduate students who have completed three years of a full-time or part-time course (annual fee $3.90). A permit will allow access to the campus between 5 p.m. and 11 p.m. 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.

Lost Property? All enquiries concerning lost property should be made to the Superintendent on extension 2503 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, scholarships 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 a.m. to 1 p.m. and 2 p.m. to 5 p.m. 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.

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".

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 University Calendar, for further information on problems associated with courses.

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

M. CHAIKIN,
Dean,
Faculty of Applied Science

FACULTY OF APPLIED SCIENCE

DEAN—Professor M. Chaikin

CHAIRMAN—Professor R. T. Fowler

SENIOR ADMINISTRATIVE OFFICER—J. D. Collins, BSc PhD *N.S.W.*

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Vacant.

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I. R. Qureshi, MSc *Panj.*, PhD *Glas.*, FGS

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TUTORS

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Wendy L. Post, BSc *N.S.W.*

A. S. Ray, MSc *Calc.*

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R. J. Haren, BSc *N.S.W.*

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Department of Oceanography

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LECTURER
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Department of Chemical Engineering

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R. M. Wood, BSc *Leeds*, PhD *Camb.*

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Department of Food Technology

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M. Wootton, BSc PhD *N.S.W.*, AAIFST, ARACI

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LECTURER
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SENIOR INSTRUCTOR
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Department of Polymer Science

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F. Williamson, MSc *Lond.*

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J. Harmer, BA DipEd *N.S.W.*
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Department of Materials

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A. S. Malin, MSc *N.S.W.*, AIM

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PROFESSOR

Vacant.

ADMINISTRATIVE ASSISTANT

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E. G. Thomas, BE PhD *Qld.*, AMAusIMM

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LECTURER

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TUTOR

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N. D. Stockton, BE *N.S.W.*

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J. A. Shonhardt, BSc(Tech) *N.S.W.*, AIM, AMAusIMM

HONORARY ASSOCIATE (School)
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PROFESSOR OF TEXTILE PHYSICS
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C. H. Nicholls, BSc *Adel.*, PhD *Leeds*, FRACI, FTI

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M. S. Nossar, DiplIng *Harbin*, PhD *N.S.W.*, FIEAust
R. Postle, BSc *N.S.W.*, PhD *Leeds*, FTI, AAIP

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T. S. Hickie, BSc PhD *N.S.W.*, ASTC
M. T. Pailthorpe, BSc PhD *N.S.W.*

PROJECT SCIENTISTS
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D. M. Rokfalussy, BE *Bud.*

SENIOR ADMINISTRATIVE OFFICER
J. Gerstel, DipTextInd *Leeds*, ATI

PROFESSIONAL OFFICERS
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N. Buchsbaum, BSc *Haifa*, MSc *N.S.W.*
M. D. Young, BSc PhD *N.S.W.*
O. Zubzanda, DiplIng *T.U. Bratislava*

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E. M. Roberts, MAgrSc *N.Z.*, PhD *N.S.W.*, MAIAS
K. J. Whiteley, BSc *N.S.W.*, PhD *Leeds*, MAIAS

SENIOR LECTURERS

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J. P. Kennedy, MSc *N.S.W.*, BSc *Oxon.*, MAIAS
J. D. McFarlane, BScAgr DipEd *Syd.*, MSc *N.S.W.*, MAIAS
A. N. Sinclair, MVSc *Syd.*, FRCVS, FACBS, MACVS

LECTURERS

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D. M. Murray, BAgrSc PhD *Melb.*, MRurSc *N.E.*

TUTOR

Jean J. Carter, MSc *Syd.*

TEACHING FELLOW

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SENIOR INSTRUCTORS

J. R. Paynter
R. E. Sallaway

ADMINISTRATIVE ASSISTANT

J. E. Lawrence

PROFESSIONAL OFFICER

E. Devaud, IngAgr *Concepción*

PROFESSIONAL OFFICERS (Faculty)

V. N. E. Robinson, BSc PhD *W. Aust.*
D. S. Santea, DiplIng *T.I. Iassy*

FACULTY INFORMATION

SCHOLARSHIPS

Sam Cracknell Memorial Scholarship

This scholarship has a value in the range $1,000 to $1,500 and is open to students who are eligible to enrol in the final year of a full-time course leading to an honours degree of Bachelor. Candidates will be evaluated not only on academic merit but on the extent to which they have participated in the sporting programme of the University.

The Fell Scholarship (University Residential Colleges)

The Fell Scholarship is available to any undergraduate who is or will be in residence at one of the Colleges under the administration of the Kensington Colleges. The annual value of the Scholarship is $100. It may be held concurrently with other scholarships.

In awarding the scholarship the academic merit and financial need of the applicant will be taken into consideration.

Applications must be made on the appropriate form and lodged with the Master, Kensington Colleges, Box 24, P.O. Kensington 2033.

Regent Scholarship in Engineering for Women Undergraduates

Mrs. G. O'Riordan and Mrs. J. Kouvelis have undertaken to provide a scholarship for female students wishing to enrol for the degree of Bachelor of Engineering in the Faculty of either Engineering or Applied Science. The scholarship is valued at $200 per annum and is normally tenable for four years.

Australian Coal Association

The Association's scholarships for students wishing to undertake degree courses in Mining Engineering or Applied Geology are under review. Further details may be obtained from Australian Coal Industry Research Laboratories Ltd., P.O. Box 169, Chatswood, N.S.W. 2067.

The Esso Scholarship in Applied Geology

The Company has made available a scholarship to the value of $600 p.a., tenable for one year. Students eligible to apply are those who themselves, or whose parents, are permanent residents of Australia, and who qualify at the annual examinations for admission to Year 4 or to the Honours year of the full-time Applied Science course in Geology or Geophysics.

The Broken Hill Pty. Co. Ltd.

Several scholarships are provided each year for students who wish to undertake degree courses in any branch of Engineering, Metallurgy, or Applied Science. Scholarships are also available to students who have completed at least one year of any of the degree courses mentioned. Students receive annually a $400 subsistence allowance, plus $115 book allowance, and a living-away-from-home allowance ($10 to $15 per week) where applicable. Application should be made to: Manager, Personnel and Training, The Broken Hill Pty. Co. Ltd., G.P.O. Box 86A, Melbourne, Vic., 3000.

Consolidated Gold Fields (Australia) Pty. Ltd.

This Company provides scholarships annually for students wishing to undertake a degree course in Mining Engineering, Metallurgy or Geology. The conditions for the scholarships are at present under review. Applications should be made to the Company, Gold Fields House, Sydney Cove.

Joint Coal Board Scholarships

The Joint Coal Board offers scholarships in full-time courses in Mining Engineering and Applied Geology.

Third year mining engineering students are expected to obtain suitable industrial training throughout Session 2 of that year. On graduation, all scholars are expected to gain employment in the coal mining industry or in a sphere closely allied thereto.

Applications on forms obtainable from headmasters or from the Secretary, Joint Coal Board, Box 3842, G.P.O. Sydney 2001 must be lodged with the Board's Secretary not later than seven days after the receipt of the Higher School Certificate results.

King Island Scheelite (1947) Limited

This Company provides up to four scholarships annually for students who have completed the first year of the degree course

in Mining Engineering, Metallurgy or Geology. The conditions for the scholarships are at present under review. Applications to the Company at 100 Collins Street, Melbourne, 3000.

Mount Lyell Mining and Railway Company

The Company makes available each year a number of scholarships for students entering the full-time degree course in Geology, Metallurgy, and Mining, Electrical or Mechanical Engineering. Applications should be made to the Mount Lyell Mining and Railways Company Ltd., Queenstown, Tasmania 7467.

N.S.W. Public Service (Department of Mines)

The Department makes scholarships available for students wishing to undertake degree courses in Mining Engineering, Geophysics, Applied Geology or Chemical Engineering. Applications to The Secretary, Public Service Board, Box 2, G.P.O., Sydney 2001.

Peko-Wallsend Investments Ltd.

One or two scholarships are provided annually for students who have completed at least one year of the degree course in Mining Engineering, Metallurgy or Geology. The conditions of the scholarships are at present under review. Applications to the Company, 47-53 Macquarie Street, Sydney 2000.

Rum Jungle Undergraduate Scholarship

One scholarship is made available annually for students wishing to do a degree course in Mining Engineering, Metallurgy or Geology. It is open only to students who matriculated at a Northern Territory school. Applications to The Manager, Territory Enterprises Pty. Ltd., P.O. Box 368, Darwin, N.T. 5794.

The A.C.I. Scholarship in Ceramic Engineering

Australian Consolidated Industries Ltd. provides a scholarship to the value of $600 p.a., tenable for four years. Candidates must have either qualified for admission to Year 1 of the Ceramic Engineering course or completed satisfactorily Year 1 of the BSc course in Ceramic Engineering or some other programme of equivalent academic standard. They or their parents must also be permanent residents of Australia.

The Australasian Vitreous Enamellers' Institute Scholarship in Ceramic Engineering

The Institute provides a scholarship, on the basis of academic

merit and personality, for students who are British subjects and who have either met University requirements for admission to Year 1 of the Ceramic Engineering course or have satisfactorily completed Year 1 of the course. The scholarship has a value of $250 p.a., and is normally tenable for four years.

Brick Manufacturers' Scholarship in Ceramic Engineering

The Brick Manufacturers' Association of New South Wales offers a scholarship in Ceramic Engineering, valued at $900 per annum to students who are British subjects and who have satisfied the conditions for admission to the first year of the Ceramic Engineering course, or who have completed satisfactorily the first year of the BSc course in Ceramic Engineering or some other programme of equivalent academic standard. The scholarship is normally tenable for four years and may be held concurrently with other scholarships.

New South Wales State Brickworks Scholarship in Ceramic Engineering

The State Brickworks of the Department of Public Works of New South Wales has made available an undergraduate scholarship in Ceramic Engineering to the value of $900 per annum for students who are British subjects and who have satisfied the conditions for admission to the first year of the Ceramic Engineering course or who have completed the first year of the BSc course in Ceramic Engineering or some other programme of equivalent academic standard. The scholarship will normally be tenable for four years.

Dalgety Australia Limited

Dalgety Australia Ltd. provides a scholarship for the Wool and Pastoral Sciences or Marketing full-time course for students eligible to enter Year 1 of either of these courses, who are British subjects and whose parents are permanently domiciled in New South Wales outside the Sydney, Newcastle and Wollongong metropolitan areas. The scholarship has a value of $800 to $1,000 per annum and is normally tenable for a period of four years. Applications must be lodged on the prescribed form with the Registrar by 14th January each year.

Gallard & Robinson Scholarship in Ceramic Engineering

Gallard & Robinson Pty. Ltd. offer, usually quadrennially, a scholarship in Ceramic Engineering to students who are British subjects and who are eligible to enter Year 1 of the Ceramic

Engineering course or who have completed satisfactorily Year 1 of the course or some other programme of equivalent academic standing. The scholarship has a value of $600 p.a., and is normally tenable for four years. Applications must be lodged on the prescribed form with the Registrar by 14th January.

The Wunderlich Scholarship in Ceramic Engineering

Wunderlich Ltd. provides a scholarship to the value of $600 p.a., tenable for four years. Candidates must have either qualified for admission to Year 1 of the Ceramic Engineering course or satisfactorily completed Year 1 of the BSc course in Ceramic Engineering or some other programme of equivalent academic standard. They or their parents must also be permanent residents of Australia.

Western Mining Corporation Ltd.

The Company provides scholarships annually to undergraduates at any Australian university who have completed at least the first year of their course in chemical engineering, metallurgy or mining engineering. The conditions of the scholarships are at present under review.

Food Technology Scholarships

A number of scholarships are usually made available by firms in the food processing industries. These scholarships have a value of $800-$1,000 per annum, payable as a living allowance to students enrolled full-time in the Food Technology degree course. These scholarships may be held concurrently with other scholarships.

Australian Industries Fuel Scholarships

Under the auspices of The Institute of Fuel (Australian Membership) a number of awards of $300 each are offered to students who are about to enrol in or have already completed one or more years of an approved course leading to professional qualifications in fuel. The awards are unbonded. Applications giving age, details of previous education, examination record and the names of two referees should reach the Honorary Secretary, The Institute of Fuel (Australian Membership), Box 169 P.O., Chatswood, N.S.W. 2067, by 1st February.

James Howden Scholarship in Fuel Engineering

James Howden & Co. provide one scholarship for students who are British subjects and qualified to enter the first or any later year of the full-time BE course in Chemical Engineering with Fuel Electives. The scholarship has a value of $300 per annum and is

normally tenable for one year but may be extended subject to satisfactory progress in the course and availability of funds.

Waste Disposal Conference Committee Scholarships in Fuel Engineering

The Waste Disposal Conference Organizing Committee provides each year two scholarships of $300 each for students eligible to enter any year of the full-time BE course in Chemical Engineering with fuel electives. The scholarships are normally tenable for one year but may be extended subject to satisfactory progress in the course and availability of funds.

School of Metallurgy Scholarships

Staff members of the School of Metallurgy have undertaken to provide finance for the establishment of undergraduate scholarships in Metallurgy. The scholarships, which are tenable at the University of New South Wales for students wishing to enrol in the first year of the full-time course for the degree of BSc (pass and honours) in Metallurgy, are tenable for four years. Each scholarship has a value of $500 per annum. In awarding the scholarships the academic merit and personality of the applicant and his interest in a career in metallurgy will be taken into account.

C.I.G.-E.M.F. Scholarships in Metallurgy

The Commonwealth Industrial Gases Ltd. provides scholarships tenable at the University of New South Wales for students wishing to enrol in the full-time course for the BSc degree in Metallurgy. The scholarships are tenable for a maximum of four years, and have a value of $600 per annum payable in fortnightly instalments as a living allowance.

Metal Manufactures Clement Blazey Memorial Scholarship in Metallurgy

Metal Manufactures Ltd. of Port Kembla provide the Clement Blazey Memorial Scholarships for students enrolling in the full-time course in Metallurgy leading to the Degree of Bachelor of Science. A scholarship is offered in each alternate year and has a value of $650 per annum payable to students as a living allowance. It is normally tenable for four years.

Mining and Metallurgical Bursaries

The Trustees of the Mining and Metallurgical Bursaries Fund offer bursaries to the value of $100 to full-time students who are British subjects and who intend to enter the mining and metallurgical industries, and who have completed, at least, the first year

of bachelor degree courses in Geology, Mining Engineering or Metallurgy. The bursaries are tenable for one year, although the same student may receive an award in successive years of his course. Closing date for applications is 31st March, and they must be lodged with the Head of the School of Mining Engineering, Metallurgy or Applied Geology.

Stan Sawyer Memorial Scholarship for Coal Mining Students

The Colliery Managers' Association of New South Wales provides one scholarship in Mining Engineering for students eligible to enter the third or fourth years of the course. The object of the scholarship, which has a value of $200 per annum, is to increase the number of mining engineers in coal mining.

Textile Technology Scholarships

The textile companies listed below have undertaken to provide a number of scholarships for students wishing to enrol in courses leading to the degree of Bachelor of Science (Pass and Honours) in Textile Technology: Bradmill Industries Ltd., Bond's Industries Ltd., F. & T. Industries (Aust.) Ltd., Fibremakers Ltd. and Prince-Smith and Stells Ltd. Each scholarship has a value of $1,000 per annum.

Wool and Pastoral Sciences Scholarships

Several firms and banks associated with the wool industry endow scholarships in courses leading to the Bachelor of Science degree in Wool and Pastoral Sciences. They are: Merck Sharp & Dohme (Aust.) Pty. Ltd., the Commercial Banking Company of Sydney Ltd., the National Council of Wool Selling Brokers of Australia and The Australian Estates Co. Ltd. Valued at $1,000 per annum, these scholarships are normally tenable for four years.

Wool Research Trust Fund Scholarships in Wool and Pastoral Sciences and Textile Technology

Two scholarships for the course in Wool and Pastoral Sciences and eight for the course in Textile Technology may be made available by the Wool Research Trust Fund (Commonwealth Government). The scholarships provide an allowance of $1,000 per annum for living expenses for four years.

Shell Refining (Australia) Pty. Ltd. Scholarship in Chemical Engineering

This scholarship has a value of $400 per annum. It is available to full-time students who have successfully completed the first year or its equivalent of the BE course in Chemical Engineering.

School/Department	*Donor/Name of Prize*	*Value* $	*Awarded for*
School of Chemical Engineering	Abbott Laboratories Pty. Ltd.	50.00	Bachelor of Engineering in Chemical Engineering—Year IV.
	Borden Chemical Co. (Aust.) Pty. Ltd.	50.00	3.124 Chemical Engineering Design and Practice.
	Chamber of Manufactures of New South Wales	10.00	Subject selected by Head of School.
	Simon-Carves (Aust.) Pty. Ltd.	21.00	3.122 Chemical Engineering, Thermodynamics and Reaction Engineering.
	The North Shore Gas Co. Ltd.	10.50	Subject selected by Head of School.
	The Shell Co. of Aust. Ltd.	75.00	3.121 Chemical Engineering Principles II and 3.123 Chemical Engineering Design IA and IB.
Department of Fuel Technology	Institute of Fuel	31.50	For a fuel subject or allied course project.
	The Shell Co. of Aust. Ltd.	75.00	Subject selected by Head of School.
School of Chemical Technology	Australian Paper Manufacturers Ltd.	21.00	Subject selected by Head of School.
	Chemical Technology Society	(i) 20.00	Bachelor of Science in Industrial Chemistry.
		(ii) 20.00	Bachelor of Science in Industrial Chemistry—Years I and II or Stages 3 to 4.
	Colonial Sugar Refining Co. Ltd.	30.00	Subject within the discipline of Industrial Chemistry, selected by Head of School.
	Stauffer Chemical Co. (Aust.) Pty. Ltd.	21.00	Subject selected by Head of School.

PRIZES (Continued)

School/Department	*Donor/Name of Prize*	*Value* $	*Awarded for*
School of Metallurgy	Alcan Australia Ltd.	50.00	Subject selected by Head of School.
	Austral Bronze Crane Copper Ltd.	100.00	Subject selected by Head of School.
	Australian Institute of Metals	30.00	Subject selected by Head of School.
	Australian Welding Institute	20.00 (book order)	Subject selected by Head of School.
	Chamber of Manufactures of New South Wales	10.00	Subject selected by Head of School.
	The Broken Hill Proprietary Co. Ltd.	50.00	Subject selected by Head of School.
	The Eagle & Globe Steel Co. Ltd.	20.00	Subject selected by Head of School.
	The Electrolytic Refining and Smelting Co. of Australia Ltd.	20.00	Subject selected by Head of School.
	Zinc Corp. Ltd.	21.00	Subject selected by Head of School.
School of Mining Engineering	Joint Coal Board	(i) 50.00	Bachelor of Engineering Course in Mining Engineering—Year II.
		(ii) 50.00	Bachelor of Engineering Course in Mining Engineering—Year III.
		(iii) 100.00	Bachelor of Engineering Course in Mining Engineering—general proficiency throughout course.

PRIZES (Continued)

School/Department	*Donor/Name of Prize*	*Value* $	*Awarded for*
School of Mining Engineering	Southern Cross Exploration N.L. Award	100.00	Bachelor of Engineering Course in Mining Engineering—general proficiency throughout course.
	Western Mining Corporation Ltd.	50.00	Bachelor of Engineering Course in Mining Engineering—general proficiency throughout course.
School of Textile Technology	J. B. Speakman	20.00	Undergraduate thesis.
	R. J. Webster	100.00	General proficiency throughout the Bachelor of Science Course in Textile Technology.
School of Wool and Pastoral Sciences	Bayer Australia Ltd.	50.00	General proficiency—Wool and Pastoral Sciences Course—Years II and III.
	Parkes Wool Promotion Committee	A shield held in the School of Wool and Pastoral Sciences on which the successful student's name is engraved each year.	Bachelor of Science Course in Wool and Pastoral Sciences—Year III.
	Samuel Clive Graham	50.00	Bachelor of Science Course in Wool and Pastoral Sciences, Year IV—Thesis.

UNDERGRADUATE COURSES

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 programme 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 programme 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 Chemical Engineering* and 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 programme is prepared. Full details are set out below under the Schools which provide the courses.

General Studies Programme

Almost all undergraduates in Faculties other than Arts and Law are required to complete a General Studies programme. The

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

only course in the Faculty of Applied Science which does not have this requirement is the Bachelor of Science course in Economic Geography.

General Rules for Progression

1. Course programmes 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 pre-requisite 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 pre-requisite 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 programme 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 programme only with permission of the Head of School. A non-standard programme 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.

SCHOOL OF APPLIED GEOLOGY

The development of natural resources 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 such subjects as Geomechanics, Mining, and Mineral Process Engineering. Courses in Surveying, Geophysics, Exploration and Mining Geology, Engineering Geology and Petroleum Geology are added to the basic geology subjects in the later stages of the course. It is also recommended that before graduation students obtain a minimum of eight weeks' professionally oriented, or industrial, experience.

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 to work on a project.

A three-year course (full-time) and a seven-year course (part-time) are also available to students in the Faculty of Science. Selected students in the Faculty of Science may read for an honours degree in Geology.

In order to meet the demands for trained Geophysicists a formal Master of Applied Science degree in Applied Geophysics is offered. This course is designed to provide the extensive training in Geophysical methods required in the exploration industry.

A Master of Applied Science course in Hydrogeology-Engineering Geology has also been instituted to train people to deal with the problems of underground water supply and of engineering design and construction.

300. Applied Geology—Full-Time Course
Bachelor of Science

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 1		Lec.	Lab. Tut.	Lec.	Lab. Tut.
25.001	Geology I*	3	3	3	3
1.001 / 1.011	Physics I *or* / Higher Physics I	3	3	3	3
2.001	Chemistry I	2	4	2	4
10.001 / 10.011	Mathematics I *or* / Higher Mathematics I	4	2	4	2
		12	12	12	12

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

YEAR 2					
25.002	Geology II†§	5	4	4	5
	General Studies Elective	1	½	1	½

Students will be required to elect to take *either:*

(a) *Three* subjects out of Group A, *or*

(b) *Two* subjects out of Group A and *one* subject out of Group B.

GROUP A

1.112A / 1.112C	Physics II *and* / Physics II ¶ *or*	2	—	5	3
1.212	Physics IIT (units B and C) *or*	1½	1½	1½	1½
2.002A	Physical Chemistry *or*	3	0	0	3
2.002C	Inorganic / Analytical Chemistry	1	3	2	0
or					
Two Units out of					
10.111A / 10.111B	Pure Mathematics II‡ *and* / Pure Mathematics‡ *or*	4	—	4	—
10.211A	Applied Mathematics II‡	2	—	2	—

GROUP B

5.010 / 5.020	Engineering A* *and* / Engineering B* *or*	4 / —	2 / —	— / 2	— / 4
17.011 / 17.021	Biology of Mankind* *and* / Comparative Functional Biology* *or*	4 / —	2 / —	— / 2	— / 4
27.001	Applied Geography I	2	4	2	4

* One session only.

† Attendance is compulsory at field tutorials, to which approximately 14 days will be devoted during the year.

§ Prerequisites: 25.001 Geology I and 2.001 Chemistry I.

‡ If 10.111 or 10.211 is taken, the totals for Lec. and Lab./Tut. vary slightly depending on the parts selected. The basic second-year mathematics course consists of the *three* units 10.111A, 10.111B and 10.211A. Students contemplating a mathematics option are advised to consult an enrolment officer from the School of Mathematics.

¶ Compulsory co-requisite 10.211A.

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 3		Lec.	Lab. Tut.	Lec.	Lab. Tut.
25.003	Geology III*‡	5	5	5	5
25.023	Geology III (Applied)†‖	5	5	5	5
	Two General Studies Electives	2	1	2	1
		12	11	12	11

* Prerequisites: 25.002 Geology II.

† Corequisites: 25.003 Geology III.

‡ In addition the field component of the course, consisting of 10 days field camp, equivalent to 2 hours per week, will be held out of session.

‖ In addition the field component of the course, consisting of 10 days, equivalent to 2 hours per week, will be held out of session.

YEAR 4*

7.023	Mining and Mineral Process Engineering	2	2	0	0
25.0041	Geology IV, Adv. Applied Geology	6	3	0	0
25.0045	Geology IV, Project	0	0	0	30
	General Studies Elective	2	1	0	0
Plus *one* of the following:					
25.0042	Geology IV, Engineering Geology	5	5	0	0
25.0043	Geology IV, Mineral Exploration	5	5	0	0
25.0044	Geology IV, Sedimentary Basins	5	5	0	0

* Session 2 is devoted to field and laboratory work on a project.

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

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, U.K., the Institution of Engineers, Australia, and the Royal Australian Chemical Institute as sufficient qualification for corporate membership.

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 1		Lec.	Lab. Tut.	Lec.	Lab. Tut.
1.001	Physics I	3	3	3	3
2.001	Chemistry I	2	4	2	4
5.010	Engineering A	4	2	—	—
5.030	Engineering C	—	—	2	4
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	2
		13	11	11	13
YEAR 2					
2.002A	Physical Chemistry	3	3	0	0
2.002B	Organic Chemistry	0	0	3	3
2.002C	Inorganic/Analytical Chemistry	0	0	3	3
3.111	Chemical Engineering Principles I	2	0	1	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	1	2
8.112	Materials and Structures	1	2	1	2
10.031	Mathematics	1	1	1	1
10.331	Statistics SS	1	1	1	1
	Two General Studies Electives	2	1	2	1

(Cont. overleaf)

* This course may be revised in 1976.

		Hours per week SESSION 1		SESSION 2	
YEAR 2 (Cont.)		Lec.	Lab. Tut.	Lec.	Lab. Tut.
	Plus *one* of the following Electives:				
3.311	Fuel Engineering I	1½	½	1½	½
4.031	Physics of Metals	1	2	1	0
25.201	Mineralogy	1	1	1	1
44.111	Microbiology	1	2	1	2
YEAR 3					
3.121	Chemical Engineering Principles II	5	6	0	3
3.122	Chemical Engineering Thermodynamics and Reaction Engineering	3	1	1	1
3.123	Chemical Engineering Design I A and B	2	0	7	5
3.124	Chemical Engineering Design and Practice*				
6.801	Electrical Engineering	1	2	1	2
10.032	Mathematics	1	1	1	1
	General Studies Elective	1	½	1	½
	Plus *one* of the following electives:				
2.013L	Chemistry and Enzymology of Foods	1	2	1	2
3.321	Fuel Engineering II	2	1	2	1
4.121	Principles of Metal Extraction	3	0	3	0
18.121	Production Management	3	0	3	0
22.113	Industrial Chemistry Processes†	1½	2½	1½	2½
	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 1A and B.
‡ Students taking a Year 2 elective at this point may prejudice their honours degree.

YEAR 4					
3.131	Chemical Engineering Principles III	3	0	1	0
3.132	Chemical Engineering Process Dynamics and Control	1½	3½	1½	3½
3.133	Chemical Engineering Design II	4	4	0	0
	General Studies Advanced Elective	1	½	1	½
	Project	0	1	0	11

(Cont. overleaf)

YEAR 4 (Cont.)

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*	2	2	2	2
3.135	Chemical Engineering Practice*	2	1	2	1
3.136	Oil and Gas Engineering	3	0	3	0
3.233	Food Technology	4	3	4	3
3.331	Fuel Engineering III	2	2	2	0
3.332	Fuel Engineering IV	2	4	2	0
3.411	Biological Process Engineering	4	3	4	3
7.314	Mineral Processing I†	6	0	6	0
18.551	Operations Research	3	0	3	0
23.051	Nuclear Power Technology	3	0	3	0
	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

The BSc(Tech) course in Chemical Engineering has been replaced 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 will be allowed to complete their degree 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

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, U.K.

DEPARTMENT OF FUEL TECHNOLOGY

This Department, the first of its kind in Australia, was established to meet the growing need of Australian industrial and research establishments for graduates trained in the science and technology of fuels and their utilization.

One constant problem of the fuel industries is that of improving and developing methods of processing and using solid, liquid and gaseous fuels to meet 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 particularly 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 chemistry, physics and engineering to the problems of Fuel Science and Engineering, Combustion Engineering and Environmental Pollution Control. Opportunities for postgraduate studies and research for higher degrees in these areas are wide-ranged and interesting.

The Council of 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. In addition, the fuel subjects in the course, if taken separately, carry exemption from the advanced fuel subjects of the London City and Guilds Institute, conducted on behalf of the Institute of Fuel, and are thus a recognized qualification for admission to corporate membership.

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

304. Chemical Engineering with Fuel Electives—Full-Time Course—Bachelor of Engineering

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 option 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 is devoted entirely to professional subjects which cover refractories and insulating materials, constitution, processing and utilization of fuels, flames and gas reactions, progress and developments in fuel science and fuel and combustion engineering. The latter includes the design, construction and performance evaluation of boilers and furnaces, instrumentation and automatic control.

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

This course is designed to provide depth and breadth in the relevant physical and biological sciences on which food technology is based. Graduates will be able to pursue more advanced studies in any of these sciences.

* This course may be modified in 1976.

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 1		Lec.	Lab. Tut.	Lec.	Lab. Tut.
1.001	Physics I	3	3	3	3
2.001	Chemistry I	2	4	2	4
10.001	Mathematics I *or*				
10.011	Higher Mathematics I	4	2	4	2
17.011	Biology of Mankind	4	2	—	—
17.021	Comparative Functional Biology	—	—	2	4
		13	11	11	13
YEAR 2					
2.002A	Physical Chemistry	3	3	0	0
2.002B	Organic Chemistry	0	0	3	3
2.002D	Analytical Chemistry	0	0	3	3
3.201	Food Technology I	1	2	1	2
10.031	Mathematics	1	1	1	1
41.101	Biochemistry I (Units A and B)	4	8	0	0
44.141	Introductory Microbiology	0	0	2	4
	General Studies Elective	1	½	1	½
		10	14½	11	13½
YEAR 3					
2.043L	Chemistry and Enzymology of Foods	2	4	2	4
3.211	Food Technology II	2	4	1	2
3.212	Food Technology III	0	0	4	8
3.231	Food Engineering I	2	1	2	1
10.331	Statistics SS	1	1	1	1
44.142	Microbiology	2	4	0	0
	General Studies Elective	1	½	1	½
		10	14½	11	16½
YEAR 4					
3.221	Food Technology IV	3	4	3	4
3.250	Project	0	8	0	8
	General Studies Elective	1	½	1	½
	General Studies Advanced Elective	1	½	1	½

(Cont. next page)

YEAR 4 (Cont.)

	Plus *one or more* of the following electives to a total of not less than 6 hrs/week				
2.003B	Organic Chemistry	2	4	2	4
3.232	Food Engineering II	3	0	3	0
18.121	Production Management	3	0	3	0
18.551	Operations Research	2	1	2	1
28.012	Marketing Models	3	1	—	—
28.022	Marketing Systems	—	—	2	2
42.102	Fermentation Technology	0	0	2	4
	—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 will be 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 will be required, and will be taken into account in the classification for the Honours list.

307. Food Technology—Part-Time Course

Bachelor of Science (Technology)

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 December 31 of the year in which the sixth stage is completed.

		Hours per week			
		SESSION 1		SESSION 2	
STAGES 1 and 2*		Lec.	Lab. Tut.	Lec.	Lab. Tut.
1.001	Physics I	3	3	3	3
2.001	Chemistry I	2	4	2	4
10.001	Mathematics I *or*	4	2	4	2
10.011	Higher Mathematics I†				
17.011	Biology of Mankind	4	2	—	—
17.021	Comparative Functional Biology	—	—	2	4
		13	11	11	13

* 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	3	3	0	0
2.002B	Organic Chemistry	0	0	3	3
2.002D	Analytical Chemistry	0	0	3	3
10.031	Mathematics	1	1	1	1
	Two General Studies Electives	2	1	2	1
		6	5	9	8
STAGE 4					
3.201	Food Technology I	1	2	1	2
41.101	Biochemistry I (Units A and B)	4	8	0	0
44.141	Introductory Microbiology	0	0	2	4
		5	10	3	6
STAGE 5					
2.043L	Chemistry and Enzymology of Foods	2	4	2	4
3.211	Food Technology II	2	4	1	2
3.213	Food Engineering I	2	1	2	1
		6	9	5	7
STAGE 6					
3.212	Food Technology III	2	0	2	8
10.331	Statistics SS	1	1	1	1
44.142	Microbiology	2	4	0	0
	General Studies Elective	1	½	1	½
		6	5½	4	9½

307. Food Technology BSc(Tech) in Full-Time/Part-Time Study

Students enrolling in the Food Technology BSc(Tech) course may reduce the time required for completion by undertaking the following programme 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 programme of 6-9 hours per week selected from undergraduate subjects on the advice of the Head of the School).

SCHOOL OF CHEMICAL TECHNOLOGY

Courses are offered on a four-year, full-time basis in the fields of Industrial Chemistry and Ceramic Engineering leading to the award of the degree of Bachelor of Science. Six-year part-time courses are also available in Industrial Chemistry and Ceramics.

Polymer Science options in the Industrial Chemistry course are provided for students with a particular interest in organic and physical chemistry who wish to make a study of macromolecules — natural and synthetic resins, plastics and elastomers.

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 designed to provide scientists trained for industries and organisations concerned with the development, manufacture and use of inorganic and organic industrial chemicals. Graduates from these courses will play an effective role in the research and development, production control, quality control and technical sales and service aspects of the chemical industries.

Arrangements have been made with the University of Wollongong for students who have completed a specified programme 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 organisations concerned with the development, manufacture and use of materials in the fields of: whitewares, structural ceramic productions, high-temperature materials,

electrical ceramics, glass, ceramic surface coatings, abrasives, cermets and nuclear ceramics. Graduates from these courses would be able to find employment in the general field of ceramics in the following capacities: ceramist or ceramic engineer on research and development, production control, quality control, product evaluation, 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 programme 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 options in the Industrial Chemistry courses and supervises Honours Projects which Industrial Chemistry students may elect to take. The options introduce Industrial Chemistry students to the basic principles of polymer chemistry and polymer physics, giving them a familiarity with the surface coatings, plastics and rubber industries.

Students wishing to receive an intensive training in polymer science are advised, on graduation, to enrol in the Graduate Diploma course in Polymer Technology.

310. Industrial Chemistry—Full-Time Course
Bachelor of Science

		Hours per week for 2 Sessions	
YEAR 1		Lec.	Lab. Tut.
1.001	Physics I	3	3
2.001	Chemistry I	2	4
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2
Plus one of:—			
5.010	Engineering A*† *and*	3	2
5.030	Engineering C*†	4	2
17.011	Biology of Mankind* *and*	4	2
17.021	Comparative Functional Biology*	2	4
25.111	Geoscience I‡	2	4

* One session only.

† Chemical Technology students take Introduction to Systems and Computers in 5.030 and Materials in 5.010.

‡ Three field excursions, up to five days in all, are an essential part of the course.

		Hours per week			
		SESSION 1		SESSION 2	
			Lab.		Lab.
YEAR 2		Lec.	Tut.	Lec.	Tut.
1.212B	Physics (Electronics)	1½	1½	0	0
2.002A	Physical Chemistry	3	3	0	0
2.042C	Inorganic Chemistry	0	0	3	3
2.002B	Organic Chemistry	1½	0	1½	3
10.031	Mathematics	1	1	1	1
10.331	Statistics SS	1	1	1	1
22.112	Chemical Process Equipment	1	0	1	0
22.122	Instrumental Analysis	1	2	1	2
	General Studies Elective	1	½	1	½
		11	9	9½	10½
YEAR 3*					
2.003B	Organic Chemistry	2	4	0	0
3.111	Chemical Engineering Principles I	2	0	1	2
3.311	Fuel Engineering I	1½	½	1½	½
22.1130	Industrial Chemistry Processes	1½	3	1½	3
22.123	Chemical Thermodynamics and Kinetics	1½	1½	1½	1½
22.133	Data Processing	1	1	3	2
22.153	Material and Energy Balances	1	2	0	0
22.163	Instrumentation and Process Control	0	0	1½	1½
	Two General Studies Electives	2	1	2	1
		12½	13	12	11½

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

Options: With the approval of the Head of School, students with an interest in Polymer Science may substitute 22.313 Polymer Processes, 22.323 Physical Chemistry of Polymers I, 22.333 Polymer Physics I and 22.1131 Organic Industrial Chemistry Processes for 22.153 Material and Energy Balances, 3.311 Fuel Engineering I and 22.1130 Industrial Chemistry Processes.

YEAR 4		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
22.114	Processes	0	0	2	0
22.124	Applied Kinetics	2	1	0	0
22.134	Applied Thermodynamics	1	1	0	0
22.144	Instrumentation and Process Control	4	4	0	0
22.154	Process Simulation	0	0	1	2
22.164	Management Science	0	0	2	0
22.174	Seminars	0	3	0	3
22.184	Process Analysis	0	0	0	4
22.194	Project	0	6	0	8
	General Studies Advanced Elective	1	½	1	½
		8	15½	6	17½

Option: With the approval of the Head of School, students who have completed the Polymer Science options in Year 3 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)

STAGES 1 and 2*		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.001	Physics I	3	3
2.001	Chemistry I	2	4
10.001 / 10.011	Mathematics I *or* Higher Mathematics I†	4	2
Plus *one* of:—			
5.010	Engineering A**§ *and*	3	2
5.030	Engineering C**§	4	2
17.011	Biology of Mankind** *and*	4	2
17.021	Comparative Functional Biology**	2	4
25.111	Geoscience I‡	2	4

* Two of the first four subjects listed will be taken in the first year, the other two in second year (as directed).

† There will be 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.

‡ Three field excursions, up to five days in all, are an essential part of the course.

		Hours per week SESSION 1		SESSION 2	
STAGE 3		Lec.	Lab. Tut.	Lec.	Lab. Tut.
1.212B	Physics (Electronics)	1	2	0	0
2.002A	Physical Chemistry	0	0	3	3
10.031	Mathematics	1	1	1	1
10.331	Statistics SS	1	1	1	1
	General Studies Elective	1	½	1	½
		4	4½	6	5½
STAGE 4					
2.002B	Organic Chemistry	3	3	0	0
2.042C	Inorganic Chemistry	0	0	3	3
22.112	Chemical Process Equipment	1	0	1	0
22.122	Instrumental Analysis	1	2	1	2
	General Studies Elective	1	½	1	½
		6	5½	6	5½
STAGE 5					
3.111	Chemical Engineering Principles I	2	0	1	2
3.311	Fuel Engineering I	1½	½	1½	½
22.1130	Industrial Chemistry Processes	1½	3	1½	3
22.153	Material and Energy Balances	1	2	0	0
		6	5½	4	5½

Option: With the approval of Head of School, students may substitute 22.313 Polymer Processes, 22.323 Physical Chemistry of Polymers I, and 22.333 Polymer Physics I and 22.1131 Organic Industrial Chemistry Processes for 22.153 Material and Energy Balances, 3.311 Fuel Engineering I and 22.1130 Industrial Chemistry Processes.

STAGE 6					
2.003B	Organic Chemistry	2	4	0	0
22.123	Chemical Thermodynamics and Kinetics	1½	1½	1½	1½
22.133	Data Processing	1	1	3	2
22.163	Instrumentation and Process Control	0	0	1½	1½
	General Studies Elective	1	½	1	½
		5½	7	7	5½

302. Ceramic Engineering—Full-Time Course
Bachelor of Science

		Hours per week			
		SESSION 1		SESSION 2	
		Lec.	Lab. Tut.	Lec.	Lab. Tut.
YEAR 1					
1.001	Physics I	3	3	3	3
2.001	Chemistry I	2	4	2	4
5.010	Engineering A*†	3	2	0	0
5.030	Engineering C*†	0	0	4	2
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	2
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)	1½	1½	0	0
1.212C	Physics (Introduction to Solids)	0	0	1½	1½
2.002A	Physical Chemistry	3	3	0	0
2.042C	Inorganic Chemistry	3	3	0	0
2.002D	Analytical Chemistry	0	0	3	3
8.112	Materials and Structures	1	2	1	2
10.031	Mathematics	1	1	1	1
10.331	Statistics SS	1	1	1	1
	General Studies Elective	1	½	1	½
		11½	12	8½	9

YEAR 3*					
3.111	Chemical Engineering Principles I	2	0	1	2
3.311	Fuel Engineering I	1½	½	1½	½
7.023	Part 2, Mineral Process Engineering	1	1	0	0
22.123A	Chemical Thermodynamics	1½	1½	0	0
22.153	Material and Energy Balances	1	2	0	0
22.213	Chemical Ceramics	2	2	2	4
22.2331	Ceramic Process Principles	1½	2½	1½	2½
22.2332	Ceramic Engineering I	1	0	1	0
25.201	Mineralogy	1	1	1	2
	Two General Studies Electives	2	1	2	1
		14½	11½	10	12

* Students who have completed a specified programme 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		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
18.121	Production Management (O.R.)	0	0	2	0
22.144	Instrumentation and Process Control	4	4	0	0
22.224	Physical Ceramics	3	3	3	3
22.234	Ceramic Engineering	2	2	2	2
22.294	Project	0	3	0	10
	General Studies Advanced Elective	1	½	1	½
		10	12½	8	15½

303. Ceramics—Part-Time Course Bachelor of Science (Technology)

STAGES 1 and 2*		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.001	Physics I	3	3
2.001	Chemistry I	2	4
5.010	Engineering A**§	3	2
5.030	Engineering C**§	4	2
10.001 / 10.011	Mathematics I *or* Higher Mathematics I†	4	2
22.231	Introductory Ceramic Engineering‡		

* Two subjects will be 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		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
1.212B	Physics (Electronics)	1	2	0	0
1.212C	Physics (Introduction to Solids)	0	0	1	2
2.002A	Physical Chemistry	0	0	3	3
10.031	Mathematics	1	1	1	1
10.331	Statistics SS	1	1	1	1
		3	4	6	7

		Hours per week			
		SESSION 1		SESSION 2	
STAGE 4		Lec.	Lab. Tut.	Lec.	Lab. Tut.
2.042C	Inorganic Chemistry	0	0	3	3
2.002D	Analytical Chemistry	3	3	0	0
8.112	Materials and Structures	1	2	1	2
	General Studies Elective	1	½	1	½
		5	5½	5	5½
STAGE 5					
3.111	Chemical Engineering Principles I	2	0	1	2
7.023	Part 2, Mineral Process Engineering	1	1	0	0
22.153	Material and Energy Balances	1	2	0	0
22.2331	Ceramic Process Principles	1½	2½	1½	2½
22.2332	Ceramic Engineering I	1	0	1	0
	General Studies Elective	1	½	1	½
		7½	6	4½	5
STAGE 6					
3.311	Fuel Engineering I	1½	½	1½	½
22.123A	Chemical Thermodynamics	1½	1½	0	0
22.213	Chemical Ceramics	2	2	2	4
25.201	Mineralogy	1	1	1	1
	General Studies Elective	1	½	1	½
		7	5½	5½	6

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 organisations concerned with the investigation and planned use of resources *et cetera.*

301. Applied Geography—Full-Time Course
Bachelor of Science

BIOGEOGRAPHY AND BIOCLIMATOLOGY

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 1		Lec.	Lab. Tut.	Lec.	Lab. Tut.
2.001	Chemistry I	2	4	2	4
10.001 10.011 10.021	Mathematics I *or* Higher Mathematics I *or* Mathematics IT	4	2	4	2
17.011	Biology of Mankind	4	2	0	0
17.021	Comparative Functional Biology	0	0	2	4
27.001	Applied Physical Geography*	2	4	2	4
		12	12	10	14
YEAR 2					
1.001	Physics I	3	3	3	3
27.011	Economic Geography (Part 1)*	2	4	0	0
27.862	Australian Environment and Land Resources*	0	0	2	3
43.101	Genetics	0	0	3	3
43.121	Plant Physiology	0	0	2	4
	General Studies Elective	1	½	1	½
		6	7½	11	13½
YEAR 3					
27.013	Geographic Methods†	0	2	0	2
27.103	Climatology	2	3½	0	0
27.203	Biogeography*	0	0	2	3½
27.333 27.413	Agricultural Geography* *or* Geomorphology*	2	2½	0	0
27.423	Pedology*	0	0	2	2½
43.111	Plant Evolution and Ecology	2	4	0	0
43.142	Environmental Botany	2	4	0	0
	Two General Studies Electives	2	1	2	1
		10	17	6	9

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

† From 1977, this subject will be replaced by 27.880 Geographic Statistics, which will be a 4 hour subject in Session 2.

YEAR 4		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
27.104	Bioclimatology*	2	4	0	0
27.204	Advanced Biogeography*	3	6	0	0
27.504	Project (Biogeography and Bioclimatology)	0	2	0	16
	General Studies Advanced Elective	1	½	1	½
		6	12½	1	16½

* Up to 5 days' field work, equivalent to 40 tutorial hours, are 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 for 2 Sessions Lec.	Lab. Tut.
2.001	Chemistry I	2	4
10.001 10.011 10.021	Mathematics I *or* Higher Mathematics I *or* Mathematics IT	4	2
25.111	Geoscience I	3	3
27.001	Applied Physical Geography*	2	4
		11	13

YEAR 2		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
1.001	Physics I	3	3	3	3
25.112	Geoscience II A and B	5	4	4	5
27.011	Economic Geography (Part 1)*	2	4	0	0
27.862	Australian Environment and Land Resources*	0	0	2	3
	General Studies Elective	1	½	1	½
		11	11½	10	11½

* Up to 5 days' field work, equivalent to 40 tutorial hours, are included in these subjects.

		Hours per week SESSION 1		SESSION 2	
YEAR 3		Lec.	Lab. Tut.	Lec.	Lab. Tut.
25.0303	Geology for Geomorphologists and Pedologists	2	2	0	2
27.103	Climatology	2	2½	0	0
27.203	Biogeography*	0	0	2	3½
27.413	Geomorphology*	2	3½	0	0
27.423	Pedology*	0	0	2	3½
27.880	Geographic Statistics	0	0	2	2
	Two General Studies Electives	2	1	2	1
		8	9	8	12
YEAR 4					
27.414	Advanced Geomorphology*	3	4	0	0
27.424	Advanced Pedology*	3	4	0	0
27.504	Project (Geomorphology and Pedology)	0	2	0	16
	General Studies Advanced Elective	1	½	1	½
		7	10½	1	16½

GEOMORPHOLOGY AND PEDOLOGY

For students enrolled for the first time prior to 1974.

YEAR 3					
25.112	Geoscience II A and B	5	4	4	5
27.013	Geographic Methods	0	2	0	2
27.103	Climatology	2	3½	0	0
27.203	Biogeography*	0	0	2	3½
27.413	Geomorphology*	2	3½	0	0
27.423	Pedology*	0	0	2	3½
	Two General Studies Electives	2	1	2	1
		11	14	10	15
YEAR 4					
25.0303	Geology for Geomorphologists and Pedologists	2	2	0	2
27.404	Advanced Geomorphology and Pedology*	3	6	0	0
27.504	Project (Geomorphology and Pedology)	0	2	0	16
	General Studies Advanced Elective	1	½	1	½
		6	10½	1	18½

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

APPLIED ECONOMIC GEOGRAPHY

For students enrolling from 1975.

YEAR 1		Hours per week for 2 Sessions Lec.	Lab. Tut.
10.001 10.011 10.021	Mathematics I *or* Higher Mathematics I *or* Mathematics IT	4	2
15.001 15.011	Economics IA *and* Economics IB	2/3	1
53.101 53.102	Sociology IA *and* Sociology IB	2	1
27.011	Economic Geography*	2	4
		10/11	8

		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
YEAR 2					
15.002	Economics IIA *and*	2	2	0	0
15.022 15.042	Economics IIB *or* Economics IIC	0	0	2	2
27.801	Introduction to Physical Geography*	2	2½	0	0
27.313	Location Analysis*	0	0	2	4

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

28.012 28.022	Marketing Systems *and* Marketing Models	3	1	2	2
28.032 28.042	Behavioural Science *and* Consumer Behaviour	3	1	2	2
15.601 15.611	Economic History IA *and* Economic History IB	2	1	2	1
53.203 53.204	Sociology IIA *and* Sociology IIB	2	2½	2	2½
YEAR 3					
27.880	Geographic Statistics	0	0	2	2

Plus *three* of the following as available (choice to be approved by Head of School):

(Cont. next page)

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

		Hours per week SESSION 1		SESSION 2	
YEAR 3 (Cont.)		Lec.	Lab. Tut.	Lec.	Lab. Tut.
27.023	Population Geography*†	2	3-4	0	0
27.113	Urban Geography*†	0	0	2	3/4
27.123	Social Geography*	0	0	2	3/4
27.303	Transportation Geography*	0	0	2	3/4
27.323	Marketing Geography*	2	3/4	0	0
27.333	Agricultural Geography*	2	3/4	0	0
	Plus *two* of the following Economics options, *one* in each session:				
15.053	Economic Development	2	1	0	0
15.003	Economics IIIA	2	1	0	0
15.023	Economics IIIB	0	0	2	2
15.043	Comparative Economic Systems	2	1	0	0
15.073	Natural Resource Economics	0	0	2	1
15.082	Labour Economics	0	0	2	1
15.093	Public Sector Economics	0	0	2	1

* Students will 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.
† Not offered in 1975.

YEAR 4

36.411	Town Planning	2	1	0	0
27.124	Geographic Thought and Perspectives	0	3	0	3
27.304	Advanced Economic Geography	2	4	0	0
27.504	Project (Economic Geography)	0	6	0	16
		4	14	0	19

APPLIED ECONOMIC GEOGRAPHY

For students enrolled prior to 1975.

YEAR 2

15.002	Economic IIA *and*	2	2	0	0
15.022 / 15.042	Economics IIB *or* / Economics IIC	0	0	2	2
27.002	Applied Geography II*	2	4	2	4

(Cont. overleaf)

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

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 2 (Cont.)		Lec.	Lab. Tut.	Lec.	Lab. Tut.
Plus *two* of the following combinations. The choice of subjects is to be approved by the Head of School.					
28.012 / 28.022	Markeing Systems *and* Markeing Models	3	1	2	2
28.032 / 28.042	Behavioural Science *and* Consumer Behaviour	3	1	2	2
15.601 / 15.611	Economic History IA *and* Economic History IB	2	1	2	1
53.203 / 53.204	Sociology IIA *and* Sociology IIB	2	2½	2	2½
YEAR 3					
27.013	Geographic Methods	0	2	0	2
27.313	Location Analysis*	0	0	2	4
	Plus *three* of the following as available (choice to be approved by Head of School):				
27.023	Population Geography*†	0	0	2	3½
27.113	Urban Geography*†	0	0	2	3½
27.123	Social Geography*	0	0	2	3½
27.303	Transportation Geography*	0	0	2	3/4
27.323	Marketing Geography*	2	3/4	0	0
27.333	Agricultural Geography*	2	3/4	0	0
	Plus *two* of the following Economics options, *one* in each session:				
15.053	Economic Development	2	1	0	0
15.003	Economics IIIA	2	1	0	0
15.023	Economics IIIB	0	0	2	2
15.043	Comparative Economic Systems	2	1	0	0
15.073	Natural Resource Economics	0	0	2	1
15.082	Labour Economics	0	0	2	1
15.093	Public Sector Economics	0	0	2	1

* Students will 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.

† Not offered in 1975.

YEAR 4		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
36.411	Town Planning	2	1	0	0
27.124	Geographic Thought and Perspectives	0	3	0	3
27.304	Advanced Economic Geography	2	4	0	0
27.504	Project (Economic Geography)	0	6	0	16
		4	14	0	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 in principle and will be offered from 1976. Students who enrol in the Bachelor of Science course in 1975 will be able to transfer, if they

so desire, to Year 2 of the Bachelor of Engineering course in 1976, with full credit for subjects passed.

The first year of the full-time Bachelor of Science course consists of physics, chemistry, mathematics, and *either* engineering *or* geoscience. Students who propose to transfer to the Bachelor of Engineering course in 1976 or later are advised to take engineering rather than geoscience in Year 1. 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.

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

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 for 2 Sessions Lec.	Lab. Tut.
1.001	Physics I	3	3
2.001	Chemistry I	2	4
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2
Plus one of:			
5.010 / 5.030	Engineering A *and* Engineering C *or*	4	2
25.111	Geoscience I	2	4
		11/13	11/13

OLD COURSE

For students who have completed Year 1 before the beginning of first session 1975.

YEAR 2		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.002A	Physical Chemistry	3	0	0	3
2.002C	Inorganic/Analytical Chemistry	1	3	2	0
4.011	Metallurgy I	5	6	5	6
4.031	Physics of Metals	1	0	1	2
10.031	Mathematics	1	1	1	1
5.010 / 5.030	Engineering A*† *and* Engineering C*† *or*	1	1	1	1
25.201	Mineralogy	1	1	1	1
	General Studies Elective	1	½	1	½
		13	11½	11	13½

* One session only.
† Part only.

YEAR 3		Hours per week for 2 Sessions Lec.	Lab. Tut.
4.012	Metallurgy II*	9	10
4.041	Mathematical Methods *or*	2½	½
6.801	Electrical Engineering	1	2
	Two General Studies Electives	2	1
		12/13½	11½/13
*Session 2		8	11

YEAR 4		Hours per week for 2 Sessions Lec.	Lab. Tut.
4.013	Metallurgy III*	8	10
4.021	Metallurgy Project†	0	5
	General Studies Advanced Elective	1	½
		9	15½

*Session 2 ..... 4 6
†From Week 12 in Session 1 ..... 0 10
Project includes three weeks' laboratory work during mid-year recess.

REVISED COURSE

For students enrolling in 1975 and later.

YEAR 2 (Operates from 1976)		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.002A	Physical Chemistry	3	3	0	0
4.302	Chemical and Extraction Metallurgy I	1	3	1	3
4.402	Physical Metallurgy I	3	3	2	3
4.602	Metallurgical Engineering I	0	0	5	3
4.802	Metallurgical Physics	2	2	0	0
10.031	Mathematics II	1	1	1	1
25.201	Mineralogy	1	1	1	1
	General Studies Elective	1	½	1	½
		12	13½	11	11½

YEAR 3 (Operates after 1976)					
4.303	Chemical and Extraction Metallurgy II	3	3	3	0
4.403	Physical Metallurgy II	3	3	3	6
4.603A	Metallurgical Engineering IIA	2	2	0	0
4.703	Materials Science	0	0	3	3
4.813	Mathematical Methods *or*	2	1	2	1
6.801	Electrical Engineering	1	2	1	2
7.023	Mineral Process Engineering Pt. 2	1	1	0	0
	Two General Studies Electives	2	1	2	1
		12/13	11/12	12/13	11/12

YEAR 4 (Operates after 1976)	Hours per week SESSION 1 Lec.	SESSION 1 Lab. Tut.	SESSION 2 Lec.	SESSION 2 Lab. Tut.
4.024 Metallurgy Project*	0	6	0	3
4.054 Metallurgy Seminar	0	2	0	2
4.304A Chemical and Extraction Metallurgy IIIA	3	1½	0	0
4.304B Chemical and Extraction Metallurgy IIIB	0	0	3	1½
4.404A Physical Metallurgy IIIA	3	1½	0	0
4.404B Physical Metallurgy IIIB	0	3	3	1½
4.504 Mechanical and Industrial Metallurgy	3	0	3	6
General Studies Advanced Elective	1	½	1	½
	10	14½	10	14½

* Project includes three weeks laboratory work during mid-year recess.

313. Metallurgy—Part-Time Course‡

Bachelor of Science (Technology)

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 1975. Students who enrol 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 for 2 Sessions Lec.	Lab. Tut.
1.001 Physics I	3	3
2.001 Chemistry I	2	4
10.001 Mathematics I *or* 10.011 Higher Mathematics I†	4	2

(Cont. next page)

* Two of the first four subjects listed will be taken in first year and the other two in second year.

† There will be no evening lectures in this subject.

‡ This course will be revised in 1975.

STAGES 1 and 2 (Cont.)		Hours per week for 2 Sessions Lec.	Lab. Tut.
Plus one of:			
5.010 Engineering A *and* 5.030 Engineering C *or*		4	2
25.111	Geoscience I	2	4

STAGE 3		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.002A	Physical Chemistry	3	0	0	3
2.002C	Inorganic/Analytical Chemistry	1	3	2	0
4.031	Physics of Metals	1	0	1	2
10.031	Mathematics	1	1	1	1
	General Studies Elective	1	½	1	½
		7	4½	5	6½

STAGE 4		Hours per week for 2 Sessions Lec.	Lab. Tut.
4.011	Metallurgy I	5	6
25.201	Mineralogy *or*	1	1
5.010 Engineering A*† *and* 5.030 Engineering C*†		1	1
		6	7

* One session only.
† Part only.

STAGE 5			
4.0121	Metallurgy IIA*	5	4
4.041	Mathematical Methods *or*	2	½
6.801	Electrical Engineering	1	2
	General Studies Elective	1	½
		7/8	5/6½
*Session 2		5	6

STAGE 6		Hours per week for 2 Sessions Lec.	Lab. Tut.
4.0122	Metallurgy IIB*	4	6½
	General Studies Elective	1	½
		5	7
*Session 2		5	6

Metallurgy BSc(Tech) in Full-Time/Part-Time Study*

Students enrolling in the Metallurgy BSc(Tech) course may reduce the time required for completion by undertaking the following programme 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 for 2 Sessions Lec.	Lab. Tut.
4.0123	Metallurgy IIC	2	2
4.0131	Seminar	0	1
4.0124	Report	0	0
		2	3

* 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 which are linked with those industries.

Since 1850 the mining industry has been a pioneering force in the development of Australia. Mining engineers who carry on this tradition realise that the problems of today are complex and require great technical skill. They are also aware that the future offers an increasing number of opportunities for mining engineers.

It is obvious that the mining industry will become, because of its rate of growth, an even greater influence in the development of this and neighbouring countries. Vigorous expansion faces the industry. For example, 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.

* 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.

314. Mining Engineering—Full-Time Course
Bachelor of Engineering

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 programme is concerned with the professional Mining Engineering subjects.

The aim of the training 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 abovementioned 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 SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
1.001	Physics I	3	3	3	3
2.001	Chemistry I *or*	3	3	3	3
2.021	Chemistry IE**	3	3	0	0
5.010	Engineering IA*	4	2	4	2
5.020	Engineering IB**	0	0	3	3
5.030	Engineering IC*	3	2	3	2
10.001 10.011	Mathematics I *or* Higher Mathematics	4	2	4	2

* 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					
4.941	Materials	1	1	0	0
5.711	Thermodynamics	1	1	0	0
6.801	Electrical Engineering	1	2	1	2
7.012	Mineral Resources Parts 1 & 2	2	0	0	0
8.151	Mechanics of Solids	2	1	2	1
8.250	Properties of Materials	2	0	0	2
8.571	Hydraulics I	1½	1½	0	0
10.022	Engineering Mathematics II	2	2	2	2
25.101	Geology for Engineers*	0	0	2	2
29.441	Engineering Surveying	0	0	2	4
29.491	Survey Camp**	0	0	0	0
	General Studies Elective	1	½	1	½
		13½	9	10	13½

* 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 will take the subjects 4.941, 25.101 and 5.711 in the first Session and the subjects 8.250 and 8.571 in the second Session. The other half will take these subjects in reverse order of sessions.

YEAR 3		Hours per week SESSION 1 Lec.	Lab. Tut.
7.023	Mining and Mineral Process Engineering—Parts 1 and 2	2	2
7.113	Mining Engineering I	5	3
7.213	Mine Surveying and Control Engineering	1	1
25.102	Geology for Engineers II*	4	4
	General Studies Elective	1	½
		13	10½

* A Geology excursion will be conducted at the end of the session.

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

YEAR 4		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
7.124	Mining Engineering II*	3	3	3	3
7.134 / 7.324	Mining Engineering III *or* Mineral Processing II	1	3	0	0
7.144 / 7.334	Mining Engineering IV *or* Mineral Processing III	0	0	1	3
7.224	Mine Valuation	1	1	0	0
7.234	Mineral Economics	0	0	1	1
7.314	Mineral Processing I*	2	4	2	4
7.414	Mineral Industry Elective Project	1	4	1	4
	General Studies Advanced Elective†	2	1	2	1
		10	16	11	16

* 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)

(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).

STAGES 1 and 2		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.001	Physics I	3	3
2.001	Chemistry I	2	4
2.021	Chemistry IE	4	2
5.010	Engineering IA†	4	2
5.020	Engineering IB	4	2
5.030	Engineering IC†	3	2
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2

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

STAGE 3		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
4.941	Materials	1	1	0	0
7.012R	Mineral Resources—Parts 1 & 2	1	0	1	0
8.151	Mechanics of Solids	2	1	2	1
8.250	Properties of Materials	0	0	2	2
10.022	Engineering Mathematics II	2	2	2	2
		6	4	7	5

STAGE 4		Hours per week for 2 Sessions Lec.	Lab. Tut.
5.611	Fluid Mechanics/Thermodynamics	2	2
7.023R	Mining and Mineral Process Engineering, Parts 1 and 2*	1	1
	General Studies Elective	1	½
25.101	Geology for Engineers‡	1	1
29.441	Engineering Surveying†	1½	1½
		6½	6

* Course consists of 44 lectures and also four visits, each of three hours, to mines or mineral processing plants.

† Includes 42 hours of practical work.

‡ Two short Geology excursions are an essential part of the course.

* 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.

		Hours per week for 2 Sessions	
STAGE 5		Lec.	Lab. Tut.
6.801	Electrical Engineering	1	2
7.113R	Mining Engineering I	2	2
7.213R	Mine Surveying and Control Engineering	1	0
25.1021	Geology for Mining Engineers*	2	2
	General Studies Elective	1	½
		7	6½

* Geology excursion will be conducted during the year.

STAGE 6			
7.124R	Mining Engineering II*	3	2
7.315R	Mineral Processing for Mining Engineers	1	2
7.414R	Mineral Industry Elective Project†	0	2
	General Studies Elective	1	½
		5	6½

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

422*. Mineral Processing—Part-Time Course

Bachelor of Science (Technology)

(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.

		Hours per week			
		SESSION 1		SESSION 2	
STAGES 1 and 2		Lec.	Lab. Tut.	Lec.	Lab. Tut.
1.001	Physics I	3	3	3	3
2.001	Chemistry I	2	4	2	4
2.021	Chemistry IE	3	3	0	0
5.010	Engineering IA†	4	2	4	2
5.020	Engineering IB	0	0	3	3
5.030	Engineering IC†	3	2	3	2
10.001 10.011	Mathematics I or Higher Mathematics I	4	2	4	2

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

* 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.

STAGE 3		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.002A	Physical Chemistry I	3	3	0	0
4.941	Materials	1	1	0	0
8.250	Properties of Materials	0	0	2	2
10.022	Engineering Mathematics II	2	2	2	2
	General Studies Elective	1	½	1	½
		7	6½	5	4½

STAGE 4		Hours per week for 2 Sessions Lec.	Lab. Tut.
2.002D	Analytical Chemistry I	1	2
7.023R	Mining and Mineral Process Engineering—Parts 1 and 2*	1	1
10.331	Statistics SS	1	1
25.101	Geology for Engineers†	1	1
25.201	Mineralogy	1	1
		5	6

* 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	1	2
7.314R	Mineral Processing I—Parts 1 & 2	3	3
7.411	Fluid Mechanics	1	1
	General Studies Elective	1	½
		6	6½

STAGE 6			
7.316R	Mineral Processing II	3	4
7.326R	Mineral Industry Processes, Parts 1 and 2	1	1
7.414R	Mineral Industry Elective Project†	0	2
	General Studies Elective	1	½
		5	7½

† The Project for an award with merit will be 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, together with a broad training in the whole 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 organisations. 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 and Applied Psychology, is especially designed to meet the undoubted 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

YEAR 1 (All courses)		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.001 / 1.011	Physics I *or* Higher Physics I	3	3
2.001	Chemistry I	2	4
5.010	Engineering A†	4	2
5.030	Engineering C‡†	3	2
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2
		12/13	11

† One session only.

‡ Textile Technology students take Engineering Drawing and Introduction to Systems and Computers.

TEXTILE CHEMISTRY

YEAR 2		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.002A	Physical Chemistry	3	3	0	0
2.002B	Organic Chemistry	2	0	1	3
2.002D	Analytical Chemistry	0	0	3	3
10.031	Mathematics	1	1	1	1
10.331	Statistics SS	1	1	1	1
13.111	Textile Technology I	3	5	3	5
13.211	Textile Science I	2	1	2	1
	General Studies Elective	1	½	1	½
		13	11½	12	14½

YEAR 3		Hours per week for 2 Sessions Lec.	Lab. Tut.
2.003A / 2.003B	Physical Chemistry / Organic Chemistry	2	4
13.112	Textile Technology II	6	7
13.212	Textile Science II	2	0
13.311	Textile Engineering I	1	0
	Two General Studies Electives	2	1
		13	12

TEXTILE PHYSICS

		Hours per week for 2 Sessions	
YEAR 2		Lec.	Lab. Tut.
1.112 1.122	Physics II *or* Higher Physics II	5	3
10.331	Statistics SS	1	1
10.111A 10.121A	Pure Mathematics II *or* Higher Pure Mathematics II	1½	½
10.111B 10.121B	Pure Mathematics II *or* Higher Pure Mathematics II	1½	½
10.211A 10.221A	Applied Mathematics II *or* Higher Applied Mathematics II	1½	½
13.111	Textile Technology I	3	5
13.211	Textile Science I	2	1
	General Studies Elective	1	½
		16½	12
YEAR 3			
1.213 1.223	Physics III* *or* Higher Physics III†	4	3
13.112	Textile Technology II	6	7
13.212	Textile Science II	2	0
13.311	Textile Engineering I	1	0
	Two General Studies Electives	2	1
		15	11

* Units A, B and C of 1.113, and 1.133A.
† Units A, B and C of 1.123, and 1.133A.

TEXTILE ENGINEERING

YEAR 2			
5.020	Engineering B*	4	2
5.311	Engineering Mechanics*	1½	½
5.611	Fluid Mechanics*	2	2
8.112	Materials and Structures	1	2
10.031	Mathematics	1	1
10.331	Statistics SS	1	1
13.111	Textile Technology I	3	5
13.211	Textile Science I	2	1
	General Studies Elective	1	½

* One session only.

YEAR 3		Hours per week for 2 Sessions Lec.	Lab. Tut.
5.111	Mechanical Engineering Design	2	2
5.331	Dynamics of Machines I	1½	½
6.801	Electrical Engineering	1	2
13.112	Textile Technology II	6	7
13.212	Textile Science II	2	0
13.311	Textile Engineering I	1	0
	Two General Studies Electives	2	1
		15½	12½

TEXTILE MANUFACTURE

YEAR 2

10.331	Statistics SS	1	1
12.101	Psychology	3	0
13.111	Textile Technology I	3	5
13.211	Textile Science I	2	1
14.501	Accounting and Financial Management IA*	4	–†
14.511	Accounting and Financial Management IB*	4	–‡
15.111	Economics IN	3	1
	General Studies Elective	1	½
		17	8½

* One session only.
† Laboratory sessions as required in Session 1.
‡ Laboratory sessions as required in Session 2.

YEAR 3

13.112	Textile Technology II	6	7
13.212	Textile Science II	2	0
13.311	Textile Engineering I	1	0
14.081	Introduction to Business Finance	2	0
26.124	Psychology	1½	½
28.012	Marketing Systems†	4	0
28.022	Marketing Models†	4	0
	General Studies Elective*	1	½
		17½	8

† One session only.
* Not to include Economics or Psychology.

YEAR 4 (All courses)		Hours per week for 2 Sessions Lec.	Lab. Tut.
13.113	Textile Technology III	4	3
13.213	Textile Science III	2	3
13.312	Textile Engineering II	1½	0
13.411	Project	0	7
	Optional*	2	0
	General Studies Advanced Elective	1	½
		10½	13½

* 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 programme to improve efficiency through research, increased extension services, and adequate publicity for wool. The full development of this programme 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 has 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 in whom has been inculcated 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 senior 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:

(i) On work carried out in the long vacation—

(a) Monthly interim reports setting out briefly the nature of the work engaged in, with any notes of topical interest.

(b) A final report on both the district and property, to be submitted within one month of resumption of lectures.

(ii) On work carried out in short vacations—A brief report to be submitted within one week of the resumption of the session.

(iii) By students who carry out work for twenty-four weeks on a property or properties—

(a) Interim reports to be submitted every two months.

(b) 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

		Hours per week for 2 Sessions	
YEAR 1		Lec.	Lab. Tut.
2.001	Chemistry I	2	4
10.001 10.011 10.021	Mathematics I *or* Higher Mathematics I *or* Mathematics IT	4	2
17.011	Biology of Mankind†	4	2
17.021	Comparative Functional Biology†	2	4
27.001	Geography*	2	4

† One session only.

* Students wishing to specialize in Wool Science or Wool Technology may substitute 1.011 Higher Physics I or 1.001 Physics I for 27.001 Geography I.

YEAR 2		Hours per week for 2 Sessions Lec.	Lab. Tut.
9.121	Livestock Production I	3	0
9.221	Agronomy	2	2
9.411	Agricultural Chemistry I	1	3
9.531	Wool Technology I	2	6
9.601	Animal Physiology I	2	3
10.331	Statistics SS	1	1
	General Studies Elective	1	½
		12	15½

YEAR 3		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
9.131	Animal Health and Preventive Medicine I	0	0	2	1
9.231	Pastoral Agronomy	1	1	2	2
9.311	Agricultural Economics I	2	0	0	0
9.801	Genetics I	2	0	2	1
41.101	Biochemistry I	4	8	2	4
	Two General Studies Electives	2	1	2	1
		11	10	10	9
	Plus at least *two* of the following subjects in each session as approved by the Head of the School (maximum 26 hours):				
9.122	Livestock Production II	1	1	0	0
9.123	Livestock Production III	0	0	1	1
9.232	Crop Agronomy	0	0	2	0
9.312	Agricultural Economics II	0	0	2	0
9.313	Farm Management I	1	1	0	0
9.314	Farm Management II	0	0	2	0
9.316	Analysis of Rural Development Projects	0	0	2	0
9.532	Wool Technology II (Wool Study)	0	2	0	2
9.533	Wool Technology III (Wool Metrology)	1	2	1	2
9.534	Wool Technology IV (Raw Materials)	0	0	2	0
9.602	Animal Physiology II	2	0	2	0

YEAR 4		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
9.001	Project	0	6	0	6
9.811	Biostatistics	2	2	2	2
	General Studies Advanced Elective	1	½	1	½

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	1	1	1	1
9.132	Animal Health and Preventive Medicine II	2	1	0	0
9.232	Crop Agronomy	0	0	2	0
9.412	Agricultural Chemistry II	2	4	2	4
9.421	Animal Nutrition	3	0	0	0
9.535	Wool Technology V	1	1	1	1
9.536	Wool Technology VI	2	2	2	2
9.603	Animal Physiology III	2	2	2	2
9.802	Genetics II	2	2	2	2
9.901	Rural Extension	2	2	2	2
9.312	Agricultural Economics II	0	0	2	0
9.313	Farm Management I	1	1	0	0
9.314	Farm Management II	0	0	2	0
9.315	Farm Management III	2	0	0	0
9.316	Analysis of Rural Development Projects	0	0	2	0
43.101C	Plant Physiology	0	0	2	4
43.102E	Environmental Botany	2	4	0	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 43.101C 43.102E	Crop Agronomy Plant Physiology Environmental Botany
17.011 17.021	*Biology of Mankind* *Comparative Functional Biology*	9.601 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'stock 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 pre-requisites.

321. Wool and Pastoral Sciences (Education Option)—Full-Time Course—Bachelor of Science

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

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 3		Lec.	Lab. Tut.	Lec.	Lab. Tut.
9.122	Livestock Production II	1	1	0	0
9.123	Livestock Production III	0	0	1	1
9.131	Animal Health and Preventive Medicine I	0	0	2	1
9.231	Pastoral Agronomy	1	1	2	2
9.311	Agricultural Economics I	2	0	0	0
9.313	Farm Management I	1	1	0	0
9.801	Genetics I	2	0	2	1
44.101	Introductory Microbiology	3	0	3	0
58.401	Education IA	3	1	2	1
58.061	Methods of Teaching*	2	1	3	0
	Two General Studies Electives	2	1	2	1
		17	6	17	7

* Teaching Practice will be 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	1	1	1	1
9.132	Animal Health and Preventive Medicine II	2	1	0	0
9.232	Crop Agronomy	0	0	1	1
9.312	Agricultural Economics II	0	0	2	0
9.315	Farm Management III	1	1	0	0
9.421	Animal Nutrition	3	0	0	0
43.101C	Plant Physiology	0	0	2	4
58.062	Methods of Teaching*	2	1	3	0
58.402	Education IIA	4	1	4	1
	Seminar and Thesis on Educational Issues	0	2	0	2
	General Studies Advanced Elective	1	½	1	½
		14	7½	14	9½

* Teaching Practice will be 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.

POSTGRADUATE 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 postgraduate 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.

POSTGRADUATE ENROLMENT PROCEDURE

Students seeking to enrol for a postgraduate degree or diploma must do so on the appropriate application form which must be lodged with the Registrar by the date specified in the conditions of the award set out in Section C of the Calendar. Successful applicants will be advised by letter of the method of enrolment.

Second and later year students must re-enrol at the beginning of each academic year in which they are proceeding to a degree or diploma. Those who have completed their formal course of study, but who have not submitted a thesis or project report to the Registrar for examination, must re-enrol and pay the appropriate fees. Details of re-enrolment procedure may be found in the current leaflet on enrolment procedure which is available from Schools and from the Admissions and Higher Degrees Section towards the end of each academic year.

Failure to comply with instructions concerning the time of enrolment or re-enrolment will incur late fees.

POSTGRADUATE FEES

As from 1st January 1974 fees for tuition were abolished. Other fees and charges remain payable. They 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.

Late fees are also charged where a student fails to observe required procedures by the appropriate time. 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 and costs of subsistence on excursions, field work etc. are payable in appropriate circumstances.

In order to become a student member of the University in any particular course of study it is necessary to meet the entrance requirements for the course and to enrol formally in it. To effect enrolment it is necessary to present a duly completed and authorised enrolment form to the University Cashier together with, where payable, either the appropriate fees or an authority authorising those fees to be charged to some other person or institution.

Completion of Enrolment

Students enrolling in postgraduate courses which include formal instruction are required to attend the appropriate enrolment centre during the prescribed enrolment period† for authorisation of course programmes. Failure to do so will incur a fee of $10.

Fees should be paid during the prescribed enrolment period but will be accepted without incurring a late fee during the first two weeks of Session 1. (For late fees see below). No student is regarded as having completed an enrolment until fees have been paid. Fees will not be accepted (i.e. enrolment cannot be completed) after 31st March except with the express approval of the Registrar, which will be given in exceptional circumstances only.

†The enrolment periods for Sydney are prescribed annually in the leaflet "Enrolment Procedure".

Students enrolling for the first time in any year at the commencement of Session 2 are required to pay all fees due within the first two weeks of that session.

Assisted Students

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

Extension of Time

Any student who is unable to pay fees by the due date may apply in writing to the Deputy Registrar (Student Services) for an extension of time. Such application must state year of study, the name of course and whether enrolment is sought on a full-time or part-time basis; it must describe clearly and fully why payment cannot be made and what extension is required; and must be lodged before the date on which a late fee becomes payable.

Normally the maximum extension of time for the payment of fees is one month for fees due in Session 1 and for one month from the date on which a late fee becomes payable in Session 2.

Failure to Pay Fees

Any student who fails to pay prescribed fees or charges or is otherwise indebted to the University and who fails to make a satisfactory settlement of his indebtedness upon receipt of due notice ceases to be entitled to the use of University facilities. Such a student is not permitted to register for a further session, to attend classes or examinations or to be granted any official credentials.

No student is eligible to attend the annual examinations in any subject where any portion of his fees for the year is outstanding after the end of the fourth week of Session 2 (15th August 1975).

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

STUDENT FEES*

All students registered for a postgraduate degree or diploma and students taking postgraduate subjects as miscellaneous subjects or to qualify for registration as a candidate for a higher degree will be required to pay:—

University Union** .... $20 entrance fee

Student Activities Fees†

University Union**	$30	annual subscription
Sports Association**	$4	annual subscription
Students' Union**	$7	annual subscription
Miscellaneous	$17	annual fee

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

Examinations conducted under special circumstances — $11 for each subject.

Review of examination result — $11 for each subject.

Breakage and Key Deposit (School of Highway Engineering) — $15 payable at beginning of course and refundable on its termination, less any charge for lost keys and/or breakages.

Late fees

Session 1

Fees paid from commencement of third week of the session to 31st March .... — $20

Fees paid after 31st March where accepted with the express approval of the Registrar (see above) .... — $40

Session 2

Fees paid in third and fourth weeks of the session — $20

Fees paid thereafter .... — $40

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

**Life members of these bodies are exempt from the appropriate fee or fees.

†The following students are exempt from the Student Activities Fees:

(a) External students

(b) Students resubmitting a thesis or project

(c) Students not in attendance at the University and who are enrolling in a thesis or project other than for the first time.

RESEARCH DEGREES — SPECIAL NOTE

A candidate who at the end of a year has completed all work for the degree other than the writing up of the thesis and who anticipates submitting the thesis to the Registrar for examination during the following year is required to re-enrol for that year and pay the appropriate student fees outlined above. However, when the student submits his thesis for examination he will receive a refund of the student fees on the same basis as if he had notified his withdrawal from the course.

LATE FEES

Initial Registration

Fees paid from commencement of sixth week after date of offer of registration to end of eighth week — $20

Renewal at commencement of each Academic Year

Fees paid from commencement of third week of Session 1 to 31st March .... — $20

Fees paid after 31st March where accepted with the express approval of the Registrar .... — $40

WITHDRAWAL FROM COURSE*

1. Students withdrawing from a course 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.
3. On notice of withdrawal:
   (a) a partial refund of the University Union Entrance Fee will be made on the following basis: any person who has paid the Entrance Fee in any year and who withdraws from membership of the University Union after the commencement of Session 1 in the same year, or who does not renew his membership in the immediately succeeding year may, on written application to the Warden receive a refund of half the Entrance Fee paid:

   (b) a partial refund of other Student Activities Fees is made on the following basis:

* Under review.

University Union — $7.50 in respect of each half session.

University of New South Wales Students' Union — where notice is given prior to end of fifth week of Session 1 $3.50; thereafter no refund.

University of New South Wales Sports Association — where notice is given prior to 30th April a full refund is made; thereafter no refund.

Miscellaneous Student Activities Fee — $4.25 in respect of each half session.

4. Where initial registration is made at the commencement of Session 2 in any year and the student subsequently withdraws a refund of fees based on the above rules may be made.

POSTGRADUATE SCHOLARSHIPS TENABLE AT THE UNIVERSITY OF NEW SOUTH WALES

Brief particulars of scholarships tenable at this University are listed below. Additional scholarships in a variety of fields become available from time to time, and the Dean of the Faculty of Applied Science and the Heads of the Schools in the Faculty will be pleased to receive inquiries concerning the availability of such scholarships.

Students completing the final year of a course may apply but, in general, applicants should hold degrees with honours or equivalent qualifications.

Applications should be lodged by 31st October with the Registrar, P.O. Box 1, Kensington, New South Wales, 2033, on forms available from the University's Scholarships Unit. Each applicant from outside this University must arrange for a transcript (in triplicate) of his academic record to be forwarded by his University to reach the Registrar at about the same time as his application. He must also arrange for reports (in triplicate) by two referees, to be forwarded direct to the Registrar. If possible, one of the reports should be from a professor, and both should be from people familiar with the applicant's academic and professional performance.

Unless otherwise stated, the annual stipend for all scholarships is $3,250 per annum, and an allowance at the rate of $520 per annum for a dependent spouse; $832 per annum for a dependent spouse and one child with a further $312 per annum for each other child. There is no means test.

University Postgraduate Research Scholarships

The University of New South Wales provides each year a number of scholarships for postgraduate study and research in any field approved by the University.

These awards are normally for graduates of Australian Universities who are domiciled in Australia. They are tenable for up to a maximum of four years, subject to annual renewal.

Australian Government Postgraduate Course Awards

The Australian Government provides a number of awards for full-time postgraduate study in courses leading to the degree of Master by formal course work. Persons permanently domiciled in Australia, preferably under 45 years of age on 1st January of the year in which the award is to be taken up, who are University graduates or will graduate in the current academic year are eligible for the awards. Preference is given to applicants with graduate employment experience, although persons without such experience are eligible to apply. Award holders receive a living allowance of $3,250 paid over the academic year. Other allowances may also be paid in certain cases. Applications for awards tenable at the University must be lodged with the Registrar by 30th September each year.

Australian Government Postgraduate Research Awards

The Australian Government also provides each year a number of awards for full-time postgraduate study and research. The awards are renewable annually up to a maximum duration of two years in the case of a candidate for a Masters degree or three years in the case of a PhD candidate. In special circumstances, a PhD candidate may be granted an extension of tenure into a fourth year. Persons permanently domiciled in Australia, preferably under 35 years of age on 1st January of the year in which the award is to be taken up, who are graduates or will graduate in the current academic year are eligible for the awards. Award holders receive a living allowance of $3,250 per annum. Other allowances may also be paid in certain cases. The closing date for applications is 31st October each year.

The General Motors-Holden's Postgraduate Research Fellowships

General Motors-Holden's Limited has agreed to provide annually eight postgraduate research fellowships throughout Australia, three to be tenable in universities in New South Wales and the Australian Capital Territory, to enable the recipients to undertake a recognized full-time course leading to the degree of Master, or Doctor of Philosophy. Stipend ranges in value from $3,300 to $3,700 p.a.

The Clean Air Society of Australia and New Zealand Scholarship in Environmental Pollution Control

The Clean Air Society provides a scholarship to enable students to proceed to a Master of Applied Science degree in Environmental Pollution Control. The scholarship has a value of $600 and is normally tenable for one year, although it may be awarded to a student doing the course in two years of part-time study, in which case the value would be $300 in each year. Applications must be lodged by 31st December each year.

Lever & Kitchen Pty. Ltd. Scholarship in Environmental Pollution Control

Lever & Kitchen Pty. Ltd. provide a scholarship to allow students to proceed to the degree of Master of Applied Science in Environmental Pollution Control. The scholarship has a value up to $2,000 per annum and is normally tenable for one year. Applications must be lodged by 31st December each year.

Australian Wool Corporation Research Scholarships in Textile Technology

Several scholarships are provided by the Australian Wool Corporation for graduates in Textile Physics, Chemistry or Engineering for research in the fields of wool textile physics, wool textile chemistry or wool textile engineering. The scholarships have a value of $3,250 per annum, plus certain allowances and are tenable for a maximum of four years, subject to annual renewal.

Australian Wool Corporation Research Scholarships in Wool and Pastoral Sciences

Scholarships provided by the Australian Wool Corporation are available for graduates in Applied Science, Science, Agricultural Science, or Veterinary Science, wishing to work in the fields of Wool and Pastoral Sciences such as Agronomy, Animal Husbandry and Parasitology.

The scholarships have a value of $3,250 per annum plus certain allowances, and are tenable for a maximum of four years, subject to annual renewal.

OTHER POSTGRADUATE AWARDS

Particulars of the conditions applying to the undermentioned awards should be obtained from the persons with whom applications are to be lodged.

C.S.I.R.O. Studentships

Studentships have a value of $3,300 per annum, plus allowances for dependants and for maintenance and travel expenses. Duration of awards is up to three years. Applications to be lodged with the Secretary, Studentship Selection Committee, C.S.I.R.O., P.O. Box 225, Dickson, A.C.T., 2602, by early November.

Rothmans Fellowships Award

The field of study is unrestricted. The range of value of the awards is: Junior—Not more than $7,750 p.a.; and Senior—Not more than $12,000 p.a. The duration of the awards is not specified. Applications should be lodged with the Secretary, Rothmans University Endowment Fund, Sydney University, by early September.

Royal Australian Chemical Institute Masson Scholarship

One scholarship is provided annually for students proceeding to a higher degree in specified fields, including Chemical Engineering, Industrial Chemistry and Metallurgy. The scholarships are tenable for one year and have a value of $1,200. Applications to the Executive Secretary, R.A.C.I., 55 Exhibition Street, Melbourne.

Australian Institute of Nuclear Science and Engineering Studentships

The Institute provides awards for students holding an Honours degree to proceed to higher degrees in specified fields, including Metallurgy. At least one-quarter of the student's period of tenure must be spent attached to the Institute at Lucas Heights, N.S.W. The awards are tenable for one to three years, and have a value ranging from $3,100 to $3,500. The Institute also provides awards for post-doctoral research for one year renewable. The value of these awards is $6,304 to $8,984.

Conzinc Riotinto of Australia Limited

The award is given for postgraduate study and research in the fields of Mining, Chemical Engineering, Geology or Metallurgy. The value of the award is $2,600 p.a. for one to three years. Where applicable, allowances may also be payable for dependants, travel, thesis and materials. Applications should be lodged with Conzinc Riotinto of Aust. Ltd., Box 384D, Melbourne, Victoria 3001, by 31st December.

Australian Meat Research Committee

The value of the awards is $3,100 p.a. plus certain allowances. They are tenable for two years, with possible extension for a further two years for study leading to the degree of Doctor of Philosophy. Applications before 31st July to the Executive Officer, Australian Meat Research Committee, Box 4129, G.P.O., Sydney, N.S.W. 2001.

OUTLINES OF POSTGRADUATE COURSES

Facilities are provided for students to carry out research for the degrees of Doctor of Philosophy, Master of Engineering or Master of Science. Master of Applied Science courses (MAppSc) and Graduate Diploma courses (GradDip) which contain a substantial component of formal study are available from a number of Schools in the Faculty. Master of Applied Science courses are offered in Hydrogeology-Engineering Geology, and Applied Geophysics by the School of Applied Geology; in Biological Process Engineering, Chemical Engineering, Environmental Pollution Control, Food Technology, Fuel Technology, and Industrial Pollution Control by the School of Chemical Engineering and in Metallurgy by the School of Metallurgy. Graduate Diploma courses are offered in: Corrosion Technology, Food Technology, and Fuel Technology by the School of Chemical Engineering; in Polymer Technology by the School of Chemical Technology; in Mining and Mineral Engineering by the School of Mining Engineering; and in Wool Technology by the School of Wool and Pastoral Sciences.

545. GRADUATE DIPLOMA IN INDUSTRIAL ENGINEERING

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 programme 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.

SCHOOL OF APPLIED GEOLOGY

802. Hydrogeology-Engineering Geology Graduate Course (Master of Applied Science)

The purpose of this course, which leads to the degree of 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 to the course is a four year degree in Geology. Other graduates with suitable academic and professional attainments may be permitted to register.

The programme may be completed in one year on a full-time basis or two years on a part-time basis. The course consists of:

25.121G Engineering Geology
25.402G Hydrogeology
25.403G Project

together with *three* of the following elective subjects to be selected according to the student's interests, after discussion with the Professor of Engineering Geology:

8.753G Soil Mechanics I
25.241G Foundation Geology
25.404G Environmental Geology
27.901G Geomorphology for Hydrologists *or*
27.904G Geomorphology for Engineering Geologists

807. Applied Geophysics Graduate Course (Master of Applied Science)

The Master of Applied Science 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 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

A total of 15 days field tutorials together with seminars form integral parts of the course.

SCHOOL OF CHEMICAL ENGINEERING

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

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 Specialising in:

800. Biological Process Engineering; 801. Chemical Engineering; 803. Food Technology; 804. Environmental Pollution Control; 806. Fuel Technology; and 808. Industrial Pollution Control. (Master of Applied Science)

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 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 programmes to the Head of the School for advice and recommendation.

An acceptable course is a programme 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 programme. This includes a project constituting not less than 15% and not more than 30% of the programme;
2. a minor strand of broader-based supporting material making up to 25% of the total programme; 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 programme.

Approximately 60% of the programme (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 University Calendar.

804. Environmental Pollution Control Graduate Course (Master of Applied Science)

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 programme, but candidates from other disciplines in Science or Engineering 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 by industrial plants.

		Hours per week for 2 Sessions Lec./Lab.
(a)		
3.170G	Process Principles or Graduate Elective	2
(b)		
3.162G	Urban Planning	½
3.164G	Medical and Legislative Aspects	1
25.701G	Subsurface Geology and Pollution Control	1
27.902G	Meteorological and Hydrological Principles	1
44.111	Microbiology	3
(c)		
3.163G	Industrial Use and Re-use of Water	1
3.242G	Treatment and Utilization of Biological Effluents	2
3.391G	Atmospheric Pollution and Control	2
3.396G	Unit Operations in Waste Management	1
	Optional Elective(s) *and*	3
3.901G	Pollution Elective	3
	or	
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 (a) and (b) 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 Course (Graduate Diploma)

The Graduate Diploma course in Corrosion Technology is open to graduates in Engineering, Applied Science or Science. 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. It is anticipated that in training personnel to reduce corrosion losses the University will make a substantial contribution to Australian industrial economics.

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 for 2 Sessions Lec./Lab.
YEAR 1		
3.170G	Process Principles *or*	
3.172G	Corrosion Laboratory	2
3.171G	Corrosion Technology I	3
		5

Chemical Engineering graduates will undertake:

3.172G Corrosion Laboratory

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

3.170G Process Principles—1 hr./wk.
3.172G Corrosion Laboratory—1 hr./wk.

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

YEAR 2		
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 Course (Graduate Diploma)

The graduate diploma course in Food Technology is designed to provide professional training at an advanced level in food technology for graduates in science, applied science or engineering who have not had previous training in this field.

In addition to a first degree, candidates may also be required to undertake assignments or complete successful examinations as directed by the Head of the School.

The course is a blend of formal lectures and laboratory work at the undergraduate and postgraduate levels. The Diploma in Food Technology (GradDip) is awarded on the successful completion of one year full-time study (18 hours a week), or two years of part-time study (9 hours a week). It involves the following programme:

		Hours per week for 2 Sessions
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 School. The hours for these electives must include at least four devoted to graduate subjects.

2.271G	Chemistry and Analysis of Foods	3
3.231	Food Engineering I	2
3.232	Food Engineering II	3
3.242G	Treatment and 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 Course (Graduate Diploma)

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

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 complete successfully examinations as directed by the Head of the School.

The Graduate Diploma in Fuel Technology 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 postgraduate levels.

		Hours per week for 2 Sessions Lec./Lab.
A. Introductory Stage (up to nine hours per week)		
3.381	Principles of Fuel Technology	3
3.382	Combustion Engineering	3
3.383	Fuel Plant Evaluation and Assignments	3
		9
B. Advanced Stage (up to nine hours per week)		
3.390G	Post-graduate Seminar	1
	Advanced Electives*	8
		9

* Subjects to be selected from the following according to availability and specialisation 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, e.g., Coal Preparation, Instrumentation and Automatic Control, Ceramics, Nuclear Engineering, etc.

SCHOOL OF CHEMICAL TECHNOLOGY

506. Polymer Technology Graduate Course (Graduate Diploma)

The Graduate Diploma course in Polymer Technology is designed for persons holding a degree, or equivalent qualifications, in Science or Engineering who wish to specialize in Polymer Technology and extend their theoretical knowledge and practical experience in fields such as plastics, rubbers, synthetic resins, adhesives and surface coatings.

Two years of study on a part-time basis are required for completion of this course, which leads to the Graduate Diploma in Polymer Technology (GradDip). However, candidates may be required, depending upon their formal training in Organic Chemistry, Physical Chemistry, Statistics and Mathematics, to spend a preliminary period of study before actually embarking upon the formal programme of the diploma.

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 1—PART-TIME		Lec.	Lab. Tut.	Lec.	Lab. Tut.
22.311G	Polymer Processes I	1	0	1	2½
22.321G	Physical Chemistry of Polymers I	1	0	1	2½
22.331G	Polymer Engineering I	2	5	2	0
		4	5	4	5
YEAR 2—PART-TIME					
22.312G	Polymer Processes II	1	2½	1	0
22.322G	Physical Chemistry of Polymers II	1	2½	1	0
22.332G	Polymer Engineering II	2	0	2	5
		4	5	4	5

SCHOOL OF METALLURGY

The School of Metallurgy conducts courses which may lead to the award of Master of Applied Science, and also, from time to time, short courses on topics in Chemical and Extractive Metallurgy and Physical Metallurgy.

In addition to these opportunities for formal postgraduate studies, 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)

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 programmes with the Head of the School for advice and recommendation.

An acceptable programme would be:

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

(b) a project comprising about twenty per cent of the programme.

At least eighty per cent of the total programme must be composed of units selected from those available as part of the postgraduate 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.

POSTGRADUATE SUBJECTS		Hours per week* for 2 sessions
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:— (a) Extractive Metallurgy (b) Metal working and forming (c) Foundry practice (d) Welding and metal fabrication (e) 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 (i.e. 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 pre- and co-requisite requirements for students whose first degree is in a field other than metallurgy.

		Hours per week for 2 sessions
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 programme.

SCHOOL OF MINING ENGINEERING

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

504. Mining and Mineral Engineering Graduate Course (Graduate Diploma)

The Graduate Diploma Course 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 mining and the beneficiation of minerals and coal.

The Graduate Diploma (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 mining or 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 programme 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	
		SESSION 1	SESSION 2
YEAR 1—PART-TIME		Lec./Lab.	Lec./Lab.
7.023	Mining and Mineral Process Engineering Parts 1 and 2	4	0
7.033	Mineralogical Assessment	1	0
7.234	Mineral Economics	0	2
7.311G	Mineral Beneficiation	0	3
7.111G	Mining Engineering	0	3
		5	8
YEAR 2—PART-TIME			
7.122G	Mining Engineering Technology	6	0
	or		
7.322G	Mineral Beneficiation Technology	6	0
7.132G	Mining Engineering Laboratory and Project	0	6
	or		
7.332G	Mineral Engineering Laboratory	0	6
		6	6

When appropriate up to three hours per week may be selected from other approved courses available within this School or those offered by other Schools within the University.

SCHOOL OF WOOL AND PASTORAL SCIENCES

508. Wool Technology Graduate Course (Graduate Diploma)

The Graduate Diploma Course 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.

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, having covered, they 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 Wool and Pastoral Sciences 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 programme 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.

		Hours per week for 2 Sessions	
		Lec.	Lab.
9.105G	Advanced Livestock Production	4	0
9.503G	Wool Study	2	4
9.711G	Advanced Wool Technology	2	2
9.902G	Techniques of Laboratory and Field Investigation	2	2
	Approved undergraduate subjects	4	4

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.

Successful completion of the course leads to the award of a Graduate Diploma (GradDip).

DETAILS OF SUBJECTS

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, will be issued by the Schools.

DEPARTMENT OF GENERAL STUDIES (HUMANITIES SUBJECTS)

Almost all undergraduate students in faculties other than Arts and Law and in the Bachelor of Science Economic Geography Course are required to study a number of General Studies subjects. Test and Reference Books for all General Studies subjects and outlines of the subjects appear in the *Department of General Studies Handbook,* which is available free of cost to all students.

SCHOOL OF PHYSICS

1.001 Physics I*

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.

* 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.

TEXTBOOK

Bueche, F. *Introduction to Physics for Scientists and Engineers,* McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Ference, M., Lemon, H., & Stephenson, R. J. *Analytical Experimental Physics.* Chicago U.P.

Halliday, D., & Resnick, R. *Physics for Students of Science and Engineering.* Vols. I & II. Wiley.

Wiedner, R. T. V., & Sells, R. L. *Elementary Classical Physics.* Vols. I and II. Allyn & Bacon.

1.011 Higher Physics I

Kinematics-Non-uniformily accelerated systems. Centripetal acceleration. Laws of motion. Momentum. Impulse. Potential and kinetic energy. Power. Conditions of equilibrium. Elasticity. Young's bulk and shear moduli. Poisson's ratio. Strain energy. Hydrodynamics. Bernouilli's equation. Motion in resistive medium. Moments of inertia. Rotational dynamics. Simple harmonic motion. Pendulums. Motion about free axis. Progressive and stationary waves. Energy current. Superposition of waves. Doppler effect. Resonance. Huygen's principle. Reflection, refraction, interference and diffraction of waves. Electromagnetic spectrum. Polarization.

Electrostatics, Gauss' theorem. Electric intensity. Capacitance. Electromagnetism. Biot-Savart and Ampere's circuital laws. Force on moving charge and on conductor. Torque on coil. D.C. instruments. Electromagnetic induction. Faraday's and Lenz's laws. Self and mutual inductance. D.C. circuits. Kirchhoff's rules and Thevenin's theorem. Growth and decay of current. A.C. circuits. Resonance. Diode. Triode. Amplifiers and oscillators. Electronic measuring instruments.

TEXTBOOKS

Halliday, D., and Resnick, R. *Physics for Students of Science and Engineering.* Vols. I and II, or combined volume. Wiley.

Russell, G. J., and Mann, K. *Alternating Current Circuit Theory.* N.S.W.U.P.

Spiegel, M. R. *Theory and Problems of Theoretical Mechanics,* Schaum.

PRINCIPAL REFERENCE BOOKS

Brophy, J. J. *Basic Electronics for Scientists.* McGraw Hill. Paperback.

Feynman, R. P., Leighton, R. B. & Sands, M. *The Feynman Lectures on Physics.* Vols. I and II. Addison Wesley.

Tomboulian, D. H. *Electric and Magnetic Fields.* Harcourt, Brace & World, N.Y., 1965.

1.071 Physics IT

See footnote to 1.001 Physics I.

1.112A Electromagnetism

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

TEXTBOOK

Reitz, J. R. and Milford, F. J. *Foundations of Electromagnetic Theory*. 2nd ed. Addison-Wesley.

PRINCIPAL REFERENCE BOOKS

Schwarz, W. M. *Intermediate Electromagnetic Theory*. Wiley, 1964.
Whitmer, R. M. *Electromagnetics*. 2nd ed. Prentice-Hall, 1963.

1.112B Modern Physics

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.

TEXTBOOKS

Beiser, A. *Perspectives of Modern Physics*. McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Arya, A. P. *Elementary Modern Physics*. Addison-Wesley.
Eisberg, R. M. *Fundamentals of Modern Physics*. Wiley.
Mermin, N. D. *Space, Time and Relativity*. McGraw-Hill.

1.112C Thermodynamics and Mechanics

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, Lagrangian mechanics, oscillations of continuous systems, waves, wave packet group velocity.

TEXTBOOKS

French, A. P. *Vibrations and Waves*. Nelson, 1971.
Mandl, F. *Statistical Physics*. Wiley, 1971.
Stephenson, R. J. *Mechanics and Properties of Matter*. Wiley, 1969.

PRINCIPAL REFERENCE BOOKS

Pain, H. G. *Physics of Vibrations and Waves*. Wiley, 1968.
Spiegel, M. R. *Theoretical Mechanics*. Schaum.
Symon, K. R. *Mechanics*. Addison-Wesley, 1960.

1.113A Wave Mechanics and Spectroscopy

Concepts, harmonic oscillator, uncertainty principle, the free particle, barriers, the hydrogen atom, many electron atoms, removal of degeneracy, spectroscopy, molecules, periodic potentials, band structure, perturbations.

TEXTBOOK

Beiser, A. *Perspectives of Modern Physics*. McGraw-Hill.

1.113B Electromagnetic Fields and Physical Optics

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., and Lipson, S. S. *Optical Physics.* C.U.P., 1969.

1.113C Statistical Mechanics and Solid State

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.* W. B. Saunders, 1969.
Jackson, E. A. *Equilibrium Statistical Mechanics.* Prentice-Hall, 1968.
Mandl, F. *Statistical Physics.* Wiley, 1971.

1.122A Electromagnetism

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

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, 1961.

PRINCIPAL REFERENCE BOOKS

Mermin, N. D. *Space and Time in Relativity.* McGraw-Hill, 1968.
Resnick, R. *Introduction to Special Relativity.* Wiley, 1968.

1.122C Thermodynamics and Mechanics

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. 1965.

PRINCIPAL REFERENCE BOOKS

Crawford, F. S. *Waves.* (Berkley Physics. Vol. III) McGraw-Hill.
Goldstein, H. *Classical Mechanics.* Addison-Wesley.
Reif, F. *Fundamentals of Statistical and Thermal Physics.* McGraw-Hill.
Spiegel, M. R. *Theoretical Physics.* Schaum.

1.123A Quantum Mechanics

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

Schiff, L. I. *Quantum Mechanics.* 3rd ed. McGraw-Hill.

1.123B Electromagnetic Theory and Statistical Mechanics

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, 1965.

PRINCIPAL REFERENCE BOOK

Knox, J. H. *Molecular Thermodynamics.* Wiley.

1.123C Solid State and Nuclear Physics

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, 1963.
Kittel, C. *Introduction to Solid State Physics.* 4th ed. Wiley.

1.133A Electronics

A.C. circuit analysis, band theory of semiconductors, diode, field effect transistor, rectifier circuits, power supplies, single and multistage amplifiers, positive feedback, oscillators.

TEXTBOOKS

Delaney, C. F. G. *Electronics for the Physicist.* Penguin, 1969.
Transistor Manual. General Electric Co.
Russell, G. J. & Mann, K. *Alternating Current Circuit Theory.* N.S.W.U.P.

PRINCIPAL REFERENCE BOOK

Brophy, J. J. *Basic Electronics for Scientists.* McGraw-Hill.

1.212 Physics IIT

Unit B (Electronics)

Vacuum tubes and applications. Conduction in solids; solid state diodes, transistors, amplifiers, feed back.

TEXTBOOK

Smith, R. J., *Circuits, Devices and Systems Theory.* 2nd ed. Wiley, 1972.

Unit C (Introduction to Physics of Solids)

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

TEXTBOOK

Rudden, M. N. & Wilson, J. *A Simplified Approach to Solid State Physics.* Butterworths, 1971.

1.213 Physics III

For Textile Physics Students.

The lectures and tutorials of 1.113, Units A, B, C and 1.133, Unit A, together with 3 hours per week laboratory work.

1.223 Higher Physics III

For Textile Physics Students.

The lectures and tutorials of 1.123, Units A, B, C and 1.133, Unit A, together with 3 hours per week laboratory work.

SCHOOL OF CHEMISTRY

2.001 Chemistry I

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, 1974.
Chemistry I Laboratory Manual. N.S.W.U.P., 1975.
Kneen, W. R., Rogers, M. J. W., & Simpson, P. *Chemistry—Facts, Patterns and Principles.* Addison-Wesley, 1972.
Schaum Outline Series. *Theory and Problems of College Chemistry.* McGraw-Hill SI (metric) ed.

PRINCIPAL REFERENCE BOOKS

Barrow, G. M., Kenney, M. E., Lassila, J. D., Litle, R. L. & Thompson, W. E. *Understanding Chemistry.* Benjamin, 1969.
Brown, G. I. *A New Guide to Modern Valency Theory.* Longman, 1967.
Eastwood, F. W., Swan, J. M. & Yonatt, J. B. *Organic Chemistry. A First University Course in Twelve Programs.* Science Press, 1967.
Gray, H. B. & Haight, G. P. *Basic Principles of Chemistry.* Benjamin, 1967.
Pauling, L. *College Chemistry.* 3rd ed. Freeman, 1964.
Runquist, O., Cresswell, C. J. & Head, J. T. *Chemical Principles. A Programmed Text.* Burgess, 1968.
Sisler, H. H., Van der Werf, C. A. & Davidson, A. W. *College Chemistry.* 3rd ed. Collier-Macmillan, 1967.
Vogel, A. I. *Macro and Semimicro Qualitative Analysis.* 4th ed. Longman, 1954.

2.002A Physical Chemistry

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, 1973.
Shaw, D. J. *Introduction to Colloid and Surface Chemistry.* 2nd ed. Butterworths, 1970.

PRINCIPAL REFERENCE BOOKS

Adamson, A. W. *Textbook of Physical Chemistry.* Academic, 1973.
Alexander, A. E., & Johnson, P. *Colloid Science.* O.U.P., 1950.
Daniels, F., & Alberty, R. A. *Physical Chemistry.* 3rd ed. Wiley, 1966.
Daniels, F. et. al. *Experimental Physical Chemistry.* 7th ed. McGraw-Hill, 1970.

Glasstone, S. *Textbook of Physical Chemistry*. 2nd ed. Van Nostrand, 1948.
Moore, W. J. *Physical Chemistry*. 4th or 5th ed. Longman, 1963 or 1972.
Shoemaker, D. P., & Garland, C. W. *Experiments in Physical Chemistry*. 2nd ed. McGraw-Hill, 1967.

2.002B Organic Chemistry

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, 1973. Int. student ed.
Vogel, A. I. *Elementary Practical Organic Chemistry*. Pt. II. Qualitative Organic Analysis. Longman, 1957 (only if proceeding to further study of Organic Chemistry).

2.002C Chemistry II (Inorganic/Analytical Chemistry)

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., 1966.
Quagliano, J. V., & Vallarino, L. M. *Coordination Chemistry*. Heath, 1969.

PRINCIPAL REFERENCE BOOKS

Basolo, F. & Johnson, R. *Coordination Chemistry*. Benjamin, 1964.
Carswell, D. J. *Introduction to Nuclear Chemistry*. Elsevier, 1967.
Cotton, F. A., & Wilkinson, G. *Advanced Inorganic Chemistry*. 2nd ed. Wiley, 1966.

2.002D Analytical Chemistry

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

Ewing, G. W. *Instrumental Methods of Chemical Analysis*. McGraw-Hill, 1969.
Fischer, R. B. & Peters, D. G. *Quantitative Chemical Analysis*. W. B. Saunders, 1968.

2.003A Physical Chemistry

Prerequisite: 2.002A.

Thermodynamics, including non-ideal systems; advanced electrochemistry; statistical thermodynamics; applications to gases, liquids and chemical equilibria; states of matter.

TEXTBOOK

Barrow, G. M. *Physical Chemistry*. 3rd ed. McGraw-Hill, 1973.

PRINCIPAL REFERENCE BOOKS

Andrews, F. C. *Equilibrium Statistical Mechanics*. Wiley, 1963.
Conway, D. E. *Theory and Principles of Electrode Processes*. Ronald, 1965.
Glasstone, S. *Textbook of Physical Chemistry*. 2nd ed. Van Nostrand, 1948.
Hill, T. L. *Introduction to Statistical Thermodynamics*. Addison-Wesley, 1960.
Knox, J. H. *Molecular Thermodynamics*. Wiley, 1971.
Moelwyn-Hughes, E. A. *Physical Chemistry*. 2nd ed. Pergamon, 1961.
Moore, W. J. *Physical Chemistry*. 4th or 5th ed. Longman, 1963 or 1972.
Purdon, S. F. & Slater, V. W. *Aqueous Solutions and the Phase Diagram*. Arnold, 1946.
Shoemaker, D. P. & Garland, C. W. *Experiments in Physical Chemistry*. 2nd ed. McGraw-Hill, 1967.
Tabor, D. *Gases, Liquids and Solids*. Penguin, 1969.

2.003B Organic Chemistry

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, Int. student ed. *or*
Roberts, J. D. & Caserio, M. C. *Basic Principles of Organic Chemistry*. Benjamin, 1964.
Tedder, J. M., Nechvatal, A., Murray, A. W. & Carnduff, J. *Basic Organic Chemistry*. Pt. 3. Wiley, 1970.
Vogel, A. I. *Elementary Practical Organic Chemistry*. Pt. II. Qualitative Organic Analysis. Longman, 1957.

PRINCIPAL REFERENCE BOOKS

Acheson, R. M. *An Introduction to the Chemistry of Heterocyclic Compounds*. 2nd ed. Wiley Int. ed., 1967.
Eliel, E. L. *Stereochemistry of Carbon Compounds*. McGraw-Hill, 1962.
Eliel, E. L., Allinger, N. L., Angyal, S. J. & Morrison, G. A. *Conformational Analysis*. Interscience, 1965.
Gould, E. S. *Mechanism and Structure in Organic Chemistry*. Holt, Rinehart & Winston, 1959.
Hallas, G. *Organic Stereochemistry*. McGraw-Hill, 1965.

March, J. *Advanced Organic Chemistry. Reactions, Mechanisms and Structure.* McGraw-Hill, 1968.
Sykes, P. *A Guidebook to Mechanism in Organic Chemistry.* 3rd ed. Longman, 1971.
Whitham, G. H. *Alicyclic Chemistry.* Oldbourne Press.

2.013A Introductory Quantum Chemistry

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

Quantum mechanical concepts. Particle in a box. Rotational and vibrational motions—spectra. The hydrogen atom. Angular momentum. Many electron atoms; effects of electron spin; atomic spectra.

Molecular Spectroscopy and Valence: Electronic structure and spectra of molecules. The Franck-Condon principle. Delocalisation; Hückel M.O. theory. Ligand field theory. Photoelectron spectroscopy.

Magnetic Resonance: Basic principles and experimental techniques; spin density effects in ESR spectra; theory of nuclear shielding and spin-spin coupling; relaxation processes.

TEXTBOOKS

Dixon, R. N. *Spectroscopy and Structure.* Methuen, 1965.
Hanna, M. W. *Quantum Mechanics in Chemistry.* 2nd ed. Benjamin, 1969.

PRINCIPAL REFERENCE BOOKS

Barrow, G. M. *Structure of Molecules.* Benjamin, 1964.
Carrington, A., & McLachlan, A. D. *Introduction to Magnetic Resonance.* Harper & Row, 1967.
King, G. W. *Spectroscopy and Molecular Structure.* Holt, Rinehart & Winston, 1964.
Phillips, L. F. *Basic Quantum Chemistry.* Wiley, 1965.

2.013L Chemistry and Enzymology of Foods

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.

TEXTBOOK

No set text.

PRINCIPAL REFERENCE BOOKS

Heftmann, E. *Chromatography.* 2nd ed. Reinhold, 1967.
Joslyn, M. A. *Methods in Food Analysis.* Academic, 1950.
Karrer, P., & Jucker, E. *Carotenoids.* Elsevier, 1950.
Markley, K. L. *The Fatty Acids.* 2nd ed. Interscience, 1960-67.

Neurath, H. *The Proteins.* Vols. I-IV. 2nd ed. Academic, 1963-68.
Pigman, W. *The Carbohydrates.* Academic, 1957.
Winton, A. L. & Winton, K. B. *Structure and Composition of Foods.* Wiley, 1932.

Subsidiary lists are supplied from the Department.

2.021 Chemistry IE

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, 1974.
Barrow, G. M., Kenney, M. E., Lassila, J. D., Litle, R. L. & Thompson, W. E. *Understanding Chemistry.* Benjamin, 1969.
Chemistry IE Laboratory Manual. N.S.W.U.P., 1975.
Turk, A., Meislich, H., Brescia, F. & Arents, J. *Introduction to Chemistry.* Academic, 1968.

PRINCIPAL REFERENCE BOOK

Munro, L. A. *Chemistry in Engineering.* Prentice-Hall, 1964.

2.022 Chemistry IIM

Units 2.002A (Physical Chemistry) and 2.002C (Inorganic Analytical Chemistry).

2.042C Inorganic Chemistry

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

1. Jolly, W. L. *The Chemistry of the Non-Metals.* Prentice-Hall, 1966.
   Larsen, E. M. *Transitional Elements.* Benjamin, 1965.
   Quagliano, J. V., and Vallarino, L. M. *Coordination Chemistry.* Heath, 1969.
   or
2. Cotton, F. A. & Wilkinson, G. *Advanced Inorganic Chemistry.* 2nd ed. Wiley, 1966.

PRINCIPAL REFERENCE BOOKS

Bailar, J. C. *Chemistry of Coordination Compounds.* Reinhold, 1960.
Barnard, A. K. *Theoretical Basis of Inorganic Chemistry.* McGraw-Hill, 1965.

Basolo, F. & Johnson, R. *Introduction to Coordination Chemistry.* Benjamin, 1964.
Graddon, D. P. *An Introduction to Coordination Chemistry.* 2nd ed. Pergamon, 1968.
Huheey, J. E. *Inorganic Chemistry, Principles of Structure and Reactivity.* Harper & Row, 1972.
Jones, M. M. *Elementary Coordination Chemistry.* Prentice-Hall, 1964.
Vogel, A. *A Textbook of Macro and Semimicro Qualitative Inorganic Analysis.* Longman.
Wells, A. F. *Structural Inorganic Chemistry.* 3rd ed. O.U.P., 1962.

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.

PRINCIPAL REFERENCE BOOKS

As for 2.013L less books of Joslyn and the Wintons, plus:

Gunstone, F. D. *An Introduction to the Chemistry and Biochemistry of the Fatty Acids and their Glycerides.* Chapman & Hall, 1968.
Reed, G. *Enzymes in Food Processing.* Academic, 1966.
Schultz, H. W. ed. *Carbohydrates and Their Roles.* Avi Publishing Co., 1969.
Schwarz, J. C. P. *Physical Methods in Organic Chemistry.* Oliver & Boyd, 1964.
Scott, G. *Atmospheric Oxidation and Antioxidants.* Elsevier, 1965.
Walton, H. F. *Principles and Methods of Chemical Analysis.* 2nd ed. Prentice Hall, 1964.
Willard, H. H., Merritt, L. L., & Dean, J. A. *Instrumental Methods of Analysis.* 4th ed. Van Nostrand, 1965.

Subsidiary lists are supplied from the Department.

2.322 Physical Chemistry II

Subject description, text and reference books as for 2.003A Chemistry III (Physical Chemistry).

2.622 Organic Chemistry II

Subject description, text and reference book lists as for 2.003B Chemistry III (Organic Chemistry).

CHEMISTRY GRADUATE SUBJECT

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

GENERAL

In addition to drawing instruments, set squares, protractor and scale-rules, which will be obtained as specified for 5.010 Engineering A and 5.030 Engineering C, each student should possess a *Slide Rule* of a type which incorporates at least *three* cycles of *each* of the exponential scales and reciprocal exponential scales. (These usually are designated on the rules as LL1, LL2, LL3 and LL01, LL02, LL03 respectively.) Suitable slide rules are: Aristo 0968, Aristo 0969, Aristo 0970, Castell 2/82, Castell 2/83, Hemmi 259D. Undoubtedly there are others equally satisfactory, but these are suggested as a guide.

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, 1968.

PRINCIPAL REFERENCE BOOK

Rich, L. G. *Environmental Systems Engineering*. McGraw-Hill, 1973.

3.111 Chemical Engineering Principles I

(*a*) *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.

(*b*) *Fluid Pumping*—Piping, fittings and valves. Blow cases, air lift pumps, reciprocating pumps, centrifugal pumps and gear pumps. Gas blowers.

(*c*) *Heat Transfer*—Simple conduction, series and parallel. Resistance concept in solids and fluid films. Heat flow in walls and pipes. Lagging and insulation—critical lagging thickness—economic lagging thickness. Simple convection—natural and forced. Nusselt equation and its implications. Logarithmic temperature difference. Scaling and fouling of surfaces. Heat transfer to boiling liquids. Simple radiation—absorptivity and emissivity. Kirchhoff's laws—black body concepts—radiation from simple and complex surfaces. Luminous and non-luminous flames.

(*d*) *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.

(*e*) *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.
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, 1971.
Perry, J. H. *Chemical Engineers' Handbook.* 4th ed. McGraw-Hill, 1963.

PRINCIPAL REFERENCE BOOKS

Badger, W. & Banchero, J. *Introduction to Chemical Engineering.* McGraw-Hill.
Johnstone, R. & Thring, H. *Pilot Plant Models and Scale-up Methods in Chemical Engineering.* McGraw-Hill.
Kreith, F. *Principles of Heat Transfer.* International Text Book.
Langhaar, H. *Dimensional Analysis and the Theory of Models.*
Lewis, W., Radasch, A. & Lewis, H. *Industrial Stoichiometry.* McGraw-Hill.
Lipka, J. *Graphical and Mechanical Computations.* Wiley.

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.* 4th Ed. McGraw-Hill, 1963.
Wales, C. E. *Programmed Thermodynamics.* Vols. I and II. McGraw-Hill, 1970.

PRINCIPAL REFERENCE BOOKS

Himmelblau, D. M. *Basic Principles and Calculations in Chemical Engineering.* 2nd ed. Prentice Hall. 1967.
Smith, J. M., & Van Ness, H. C. *Introduction to Chemical Engineering Thermodynamics.* 2nd ed. McGraw-Hill, 1959.

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—Evaporation and crystallization processes. Convective heat transfer rates, boiling and condensing heat transfer coefficients. Unsteady state conduction and convection.

Flow of Fluid-Solid Systems—Flow of solids in fluids—sedimentation. Flow of fluids in solids—packed beds—single and two phase flow. Fluidisation. 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, Int. Student ed. 1972.
Perry, J. H. *Chemical Engineers' Handbook.* 4th ed. McGraw-Hill, 1963.
Peterson, G. R. *Basic Analog Computation.* Collier Macmillan, 1967.

PRINCIPAL REFERENCE BOOKS

Foust, A. S. et al. *Principles of Unit Operations.* Wiley.
Kreith, F. *Principles of Heat Transfer.* International Text Book Co.
Larian, M. G. *Fundamentals of Chemical Engineering Operations.* Constable.
Levenspiel, O. *Chemical Reaction Engineering.* Wiley, 1962.
Purchas, D. B. *Industrial Filtration of Liquids.* Leonard Hill, 1967.
Scheidegger, A. E. *The Physics of Flow Through Porous Media.* Univ. of Toronto Press, 1957.

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: (a) interpretation of batch reactor data and testing of mechanisms; (b) isothermal ideal reactor design (i) single reactions (ii) multiple reactions: (c) adiabatic ideal reactor design—single and multiple reactions—optimization. Heterogeneous reactions including (a) flow models—dispersion—mixing residence time distribution (b) reactor design in non-catalytic fluid/solid reactions, catalytic fluid/solid reactions and fluid/fluid reactions. A selection of topics from (a) mass transfer with chemical reaction (b) reactor stability (c) optimal reactor design (d) analysis of reactor/reactions.

TEXTBOOKS

Hougen, O., Watson, K., & Ragatz, R. *Chemical Process Principles. Part II Thermodynamics.* 2nd ed. Wiley.
Levenspiel, O. *Chemical Reaction Engineering.* 2nd ed. Wiley, 1973.
or
Smith, J. M. *Chemical Engineering Kinetics.* 2nd ed. McGraw-Hill, 1970.

PRINCIPAL REFERENCE BOOKS

Pourbaix, M. J. N. *Atlas of Electrochemical Equilibria in Aqueous Solutions.* Pergamon.
Smith, J. M., and Van Ness, M. C. *Introduction to Chemical Engineering Thermodynamics.* 2nd ed. McGraw-Hill, 1959.
Swalin, R. A. *Thermodynamics of Solids.*

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—Types of heat exchangers, evaporators and crystallizers. Service fluids for heating and cooling at various temperature levels. Construction and design of shell and tube, concentric tube and plate exchangers for liquids, gases, condensing vapours and boiling liquids.

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, 1973.
Coughanowr, D. R., and Koppel, L. B. *Process Systems Analysis and Control.* McGraw-Hill, 1965.
Holman, J. P. *Experimental Methods for Engineers.* 2nd ed. I.S.E.
Kern, D. Q. *Process Heat Transfer.* McGraw-Hill, 1950.
Mott, L. C. *Engineering Materials for M.E.T.* Part 2, O.U.P. 1970.
Perry, J. H. ed. *Chemical Engineers' Handbook.* 4th ed. McGraw-Hill. 1963.
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, 1968.
Uhlig, H. H. *Corrosion and Corrosion Control.* Wiley, 1963.
A.S. 1210-1972. *Unfired Pressure Vessels.* Standards Association of Australia.

PRINCIPAL REFERENCE BOOKS

Bickell, M. B. & Ruiz, C. *Pressure Vessel Design and Analysis.* Macmillan, 1967.
Brownell, L. E. & Young, E. H. *Process Equipment Design.* Wiley.
Buchanan, R. H. & Sinclair, C. G. *Costs and Economics of the Australian Process Industries.* West.
Fontana, M. G. & Greene, N. D. *Corrosion Engineering.* Wiley, 1970.

Johns, V. B. *Introduction to Engineering Materials.* Macmillan, 1972.
Nelson, W. L. *Petroleum Refinery Engineering.* 4th ed. McGraw-Hill. Int. Student ed. 1958.
Rabald, E. *Corrosion Guide.* Elsevier, 1970.
Speller, F. *Corrosion — Causes and Prevention.* McGraw-Hill, 1969.
Stewart, D. & Tullock, D. S. *Principles of Corrosion and Protection.* Macmillan, 1968.
B.S. 1500 and B.S. 1515 *Fusion Welded Pressure Vessels.* British Standard Institution.

3.124 Chemical Engineering Design and Practice

Design Report. The basis of this subject is a design report which will be 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 (e.g. extractor and fractionator, reactor and separator, etc.). Particular attention is paid to operating instructions, hazards and safety, economic evaluation, use of standards and general presentation.

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 programmes such as CSMP; introduction to other high-level programmes and PLI.

TEXTBOOKS

Beveridge, G. S., & Schechter, R. S. *Optimization Theory and Practice.* McGraw-Hill, 1970.
Bird, R. B., Stewart, W. E., & Lightfoot, E. N. *Transport Phenomena.* Wiley, 1962.
Pennington, R. H. *Introductory Computer Methods and Numerical Analysis.* Macmillan, London, 1970.

PRINCIPAL REFERENCE BOOKS

Crowe, C. M. *Chemical Plant Simulation.* Prentice-Hall, 1971.
Germaine, C. *Programming the I.B.M. 1620.* 2nd ed. Prentice-Hall, 1965.
Himmelblau, D. M. *Process Analysis by Statistical Methods.* Wiley, 1970.
Wilde, D. J. & Beightler, C. S. *Foundations of Optimization.* Prentice-Hall, 1967.

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 characterisation 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, 1965.

PRINCIPAL REFERENCE BOOKS

Campbell, D. P. *Process Dynamics.* Wiley, 1958.
Perlmutter, D. D. *Introduction to Chemical Process Control.* Wiley, 1965.

3.133 Chemical Engineering Design II

(*a*) *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. (*b*) *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. (*c*) *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, 1973.
Peters, M. S. & Timmerhaus, K. D. *Plant Design and Economics for Chemical Engineers.* 2nd ed. McGraw-Hill, 1968.
Rudd, D. F. & Watson, C. C. *Strategy of Process Engineering.* Wiley, 1968.

PRINCIPAL REFERENCE BOOKS

Astarita, G. *Mass Transfer with Chemical Reaction.* Elsevier, 1967.
Buchanan, R. H., & Sinclair, C. C. eds. *Costs and Economics of the Australian Process Industries.* West, 1964.
Industrial Ventilation. Amer. Soc. of Govt. Indus. Hygienists. Washington, 1966.
Danckwerts, P. V. *Gas-Liquid Reactions.* McGraw-Hill, 1970.
Jelen, F. C. ed. *Cost and Optimization in Engineering.* McGraw-Hill, 1970.

Ludwig, E. E. *Applied Process Design for Chemical and Petrochemical Plants.* Vols. I, II, III. Gulf Pub. Co., 1964-5.
Pilborough, L. *Inspection of Chemical Plant.* CRC Press, 1971.
Act. No. 43, *1962 Factory, Shops and Industries Act.* As amended by Act No. 58, 1964. Government Printer.
AS C25-1952 *General Principles for Safe Working in Industry,* Standards Association of Australia.

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.* Associated experimental laboratory studies.

TEXTBOOKS

Bird, R. B., Stewart, W. E., & Lightfoot, E. N. *Transport Phenomena.* Wiley, 1962.
Massey, B. S. *Mechanics of Fluids.* 2nd ed. Van Nostrand-Reinhold, 1971.

PRINCIPAL REFERENCE BOOKS

Hala, E. et al. *Vapour-Liquid Equilibrium.* 3rd ed. Pergamon, 1969.
Hoffman, E. J. *Azeotropic and Extractive Distillation.* Interscience, 1964.
Smith, B. D. *Design of Equilibrium Stage Processes.* McGraw-Hill, 1967.

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.

CHEMICAL ENGINEERING GRADUATE SUBJECTS

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 and Legislative 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. 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 techn ques 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—nonmetallic:* 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, e.g. 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, e.g. 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: e.g. 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 transfer 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, bubble-phase theories, instability theories, grid-bed geometry and resistance relationships, elutriation, residence-time and size-distribution studies. Heat and mass transfer: design of catalytic and non-catalytic fluidized reactors.

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, e.g. 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 (i) high pressure; (ii) multicomponent systems. Chemical reaction equilibrium for complex systems.

Molecular theory and statistical thermodynamics: partition functions, monatomic and diatomic gases; Chapman-Enskog theory, evaluation of (i) thermodynamic potentials; (ii) virial coefficients.

Compressible flow: flow of compressible fluids in ducts including (i) supersonic flow; (ii) shock waves; (iii) stagnation properties.

3.192G Computer-aided Design

A workshop type of course with considerable time devoted to discussion, seminars, writing and running of programmes.

Programming. Methods, conventions, and standards. Programme 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

PRINCIPAL REFERENCE BOOKS

Please consult Department.

3.201 Food Technology I

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

TEXTBOOK

Janick, J. *Horticultural Science*. 2nd ed. Freeman, 1972 *or* Janick, J., Schery, R. W., Woods, F. W. & Ruttan, V. W. *Plant Science*. Freeman, 1969.

3.211 Food Technology II

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, 1966.

Earle, R. L. *Unit Operations in Food Processing.* Pergamon, 1966.

Frazier, W. C. *Food Microbiology.* 2nd ed. McGraw-Hill, 1967.

Hersom, A. C., & Hulland, E. D. *Canned Foods: an Introduction to their Microbiology.* Churchill, 1969.

Nickerson, J. T., & Sinskey, A. J. *Microbiology of Foods and Food Processing.* Elsevier, N.Y., 1972.

3.212 Food Technology III

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, 1967.

Kent, N. L. *Technology of Cereals.* Pergamon, 1966.

Knight, J. W. *The Starch Industry.* Pergamon, 1966.

Lawrie, R. A. *Meat Science.* 2nd ed. Pergamon, 1974.

3.221 Food Technology IV

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.

3.231 Food Engineering I

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

TEXTBOOKS

Brennan, J. G., Butters, J. R., Cowell, N. D. and Lilly, A. E. V. *Food Engineering Operations.* Elsevier, 1969.

Earle, R. L. *Unit Operations in Food Processing.* Pergamon, 1966.

Kay, J. M. *An Introduction to Fluid Mechanics and Heat Transfer.* 2nd ed. C.U.P., 1963.

3.232 Food Engineering II

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)

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)

Project in Food Technology for students in Chemical Engineering.

3.250 Food Technology Project

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.

FOOD TECHNOLOGY GRADUATE SUBJECTS

3.213G Food Process Laboratory

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

3.241G Food Technology

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

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 Graduate Seminar

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

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 on the use and development of new technologies in the broad areas of dairy product processing.

3.245G Food Quality Assessment

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

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 Enology

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

Sanitation in food processing, distribution and handling. Water supplies, utilisation and disposal, insect and rodent control. Cleaning, disinfection, sanitation programmes. 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 Foods Act, Public Health Act.

3.249G Technology of Cereal Products

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

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

DEPARTMENT OF FUEL TECHNOLOGY

3.311 Fuel Engineering I

1. *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.

2. *Energy Conversion*—An introduction to the combustion of gaseous, liquid and solid fuels; design principles and types of steam-raising plant.

3. *Fuel Processing*—Crude oil, refinery flow patterns, general methods of gas making, carbonisation and the production of metallurgical coke.

4. *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, Oxford, 1966.

PRINCIPAL REFERENCE BOOKS

Ministry of Power (U.K.). *The Efficient Use of Fuel.* H.M.S.O.

Inst. of Petroleum. *Modern Petroleum Technology.*

Dept. of Nat. Development. *Energy in Australia.*

Standards Assoc. of Aust. Various standards on Sampling, Analysis and Classification of Fuels, and Glossary of Terms.

3.321 Fuel Engineering II

1. *Combustion of Gaseous Fuels*—Basic principles, kinetics, chemical, physical and aerodynamic considerations; an introduction to flames.

2. *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.

3. *Principles of Gasification*—Thermodynamics of basic reactions and calculations of equilibrium compositions. The production of fuel and synthesis gases, controlled furnace atmospheres; gas purification.

4. *Fuel Plant Technology*—Introduction to furnaces, ovens, kilns and steam generators. Thermodynamics of heating processes; recoverable and returnable heat in fuel systems. Industrial water.

TEXTBOOKS

Spiers, H. *Technical Data on Fuel.* W.P.C., London.
Thring, M. *The Science of Flames and Furnaces.* Chapman & Hall.

PRINCIPAL REFERENCE BOOKS

Field, M. A., et al. *Combustion of Pulverised Coal.* B.C.U.R.A.
Gaydon, A., & Wolfhard, H. *Flames.* Chapman & Hall.
Gumz, W. *Gas Producers and Blast Furnaces.* Wiley.
Johnson, H. R., & Littler, D. J. *The Mechanism of Corrosion by Fuel Impurities.* Butterworths.
Lyle, O. *Efficient Use of Steam.* H.M.S.O., London.
Smith, M., & Stinson, K. *Fuels and Combustion.* McGraw-Hill.

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, 1950.
McAdams, W. H. *Heat Transmission.* McGraw-Hill.
Trinks, W. *Industrial Furnaces.* Vols. 1 and 2. Wiley.

PRINCIPAL REFERENCE BOOKS

Etherington, H. G. *Modern Furnace Technology.* 3rd ed. Griffin.
Field, M. A., et. al. *Combustion of Pulverised Coal.* B.C.U.R.A.
Lowry, H. H., *Chemistry of Coal Utilization.* Wiley, 1963.
Lyle, O., *Efficient Use of Steam.* H.M.S.O., London.
Schack, A. *Industrial Heat Transfer.* Chapman & Hall.

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.

PRINCIPAL REFERENCE BOOKS

Lowry, H. H. *Chemistry of Coal Utilization—Supplementary Vol.* Wiley.
Van Ness, K. & Van Weston, K. *Aspects of the Constitution of Mineral Oils.* Elsevier.
Wilson, P. J. & Wells, J. H. *Coal, Coke and Coal Chemicals.* McGraw-Hill.
Drinker, P. & Hatch, T. *Industrial Dusts.* McGraw-Hill.
Spalding, D. B. *Some Fundamentals of Combustion.* Butterworths.
Nelson, W. *Petroleum Refinery Engineering.* McGraw-Hill.
Strauss, W. *Industrial Gas Cleaning.* Pergamon.
Norton, F. H. *Refractories.* McGraw-Hill.
Fristrom, R. M., & Westenberg, A. A. *Flame Structure.* McGraw-Hill.

3.340 Fuel Engineering Project

Projects will be selected involving the design of fuel plant or aspects of fuel science and/or fuel processing and utilization. This will usually involve some experimental work.

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

FUEL TECHNOLOGY GRADUATE SUBJECTS

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 post-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 is a bridge course of lectures in heat transfer, fluid mechanics, and chemical and engineering thermodynamics, which is 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., 1973.
Perkins, H. C. *Air Pollution.* McGraw-Hill, 1974.

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 some of the subject-matter of 3.331.

TEXTBOOKS

As for 3.331.

3.394G Thermal Engineering and Fuel Processing

Advanced heat transfer with applications to flames and fuel utilization. The aerodynamics of fuel and combustion plant; dimensional analysis and models; flame temperature.

Coal carbonization and by-product recovery. Petroleum processing and properties of liquid fuel products; thermodynamics of gasification reactions; controlled atmospheres.

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:

(*a*) Advanced analytical techniques (e.g. spectroscopy, X-ray diffraction, chromatography, mass spectroscopy. N.M.R., other optical and instrumental methods. (*b*) Mathematical methods in the design and interpretation of experiments, e.g., 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 N.S.W.

PRINCIPAL REFERENCE BOOKS

First Aust. Refuse Disposal Conference Proceedings. Dept. of Fuel, Univ. of N.S.W., 1967.

Corey, R. C. *Principles and Practices of Incineration.* Wiley, Interscience.

The Incineration of Municipal and Industrial Wastes. Proceedings of Conference, Inst. of Fuel, 1969.

U.S. Dept. of Health, Education and Welfare. *The Role of Packaging in Solid Waste Management 1966 to 1976.* 1969.

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.

BIOLOGICAL PROCESS ENGINEERING GRADUATE SUBJECTS

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, e.g., 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; (i) research tool; (ii) industrial fermentations; (iii) effluent treatment; (iv) 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 emphasising 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 co-efficients, non-Newtonian flow. Unsteady state heat transfer by conduction, convection and radiation.

3.482G Thermodynamics of Biological Systems

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 techniques employed. Dynamics of batch and flow processes with living organisms. Unstable systems.

Engineering design and operating characteristics of plant and processes normally used, e.g., 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

A short report on some aspect of pollution and its control taken in conjunction with a formal subject selected by the candidate.

SCHOOL OF METALLURGY

Revised Subjects. Details of the Subjects 4.054, 4.302, 4.303, 4.304A, 4.304B, 4.402, 4.403, 4.404A, 4.404B, 4.504, 4.602, 4.603A, 4.703, 4.802 and 4.813, which form part of the revised BSc course in metallurgy, are available from the Head of the School.

4.001 Introduction to Materials Science

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

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.

PRINCIPAL REFERENCE BOOKS

Woodcock, J. T. *The Australian Mining, Metallurgical and Mineral Industry, Vol. 3 Eighth Commonwealth Mining and Metallurgical Congress.* A.I.M.M.
Aitchison, L. *A History of Metals, Vols. I and II.* McDonald & Evans.
Dennis, W. H. *Extractive Metallurgy.* McGraw-Hill.
Guy, A. C. *Physical Metallurgy for Engineers.* Addison-Wesley.

4.011 Metallurgy I

(*a*) *General Introduction to Metallurgy.*

(*b*) *Physical Metallurgy*—The crystalline structure and physical properties of solids. Structure sensitive and structure insensitive properties. Specific heat of soilds. 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.

(*c*) *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.

(*d*) *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.

PRINCIPAL REFERENCE BOOKS

Bennett, C. O. & Myers, J. E. *Momentum, Heat and Mass Transfer*. McGraw-Hill.
Boas, W. *Introduction to the Physics of Metals and Alloys*. M.U.P.
Darken, L. S. & Gurry, R. W. *Physical Chemistry of Metals and Alloys*. McGraw-Hill.
Dennis, W. H. *Metallurgy of the Ferrous Metals*. Pitman.
Dennis, W. H. *Metallurgy of the Non-Ferrous Metals*. Pitman.
Dieter, G. E. *Mechanical Metallurgy*. McGraw-Hill.
Gilchrist, J. D. *Fuels and Refractories*. Pergamon.
Kehl, G. L. *Principles of Metallographic Laboratory Practice*. 3rd ed. McGraw-Hill.
McGannon, H. E. *The Making, Shaping and Treating of Steel*. 8th ed. U.S. Steel.
Perry, J. H. *Chemical Engineers Handbook*. McGraw-Hill.
Themelis, N. & Szekely, J. *Rate Phenomena in Process Metallurgy*. Wiley.
Woodcock, J. T. ed. *Eighth Commonwealth Mining and Metallurgical Congress*. Vol. 3. Aus. I.M.M.

4.012 Metallurgy II

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

(*b*) *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.

(*c*) *Physical Metallurgy*—Theories of diffusion, phase equilibrium and transformation, and their application to alloying, heat treatment, and other metallurgical processes.

(*d*) *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.

(*e*) *Mineral Processing*—The principles and practice associated with liberation, beneficiation, froth flotation, hydrometallurgy, materials handling and process engineering.

(*f*) *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.

(*g*) *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.

(*h*) *Special Topics*—Further development of topics from the above sections.

TEXTBOOKS

As for 4.011 Metallurgy I, plus:

Barrett, C. S. *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., and Gurry, R. W. *Physical Chemistry of Metals.* McGraw-Hill.
Hull, D. *Introduction to Dislocations.* Pergamon.
Mann, J. Y. *Fatigue of Materials.* M.U.P., 1967.
Swalin, R. A. *Thermodynamics of Solids.* Wiley.
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).

PRINCIPAL REFERENCE BOOKS

As for 4.011 Metallurgy I, together with—

Bain, E. C. & Paxton, H. W. *Alloying Elements in Steel.* 2nd ed. A.S.M.
Birchenall, C. *Physical Metallurgy.* McGraw-Hill.
Bockris, J. O'M., White, J. L. & Mackenzie, J. D. *Physiochemical Measurements at High Temperatures.* Butterworths.
Burkin, A. R. *Chemistry of Hydrometallurgical Processes.* Spon.
Campbell, I. E. *High Temperature Technology.* Wiley.
Cottrell, A. H. *Dislocations and Plastic Flow in Crystals.* McGraw-Hill.
Cullity, B. D. *Elements of X-ray Diffraction.* Addison-Wesley.
Grossman, M. A. *Elements of Hardenability.* A.S.M.
Hume-Rothery, W. *Atomic Theory for Students of Metallurgy.* Inst. of Metals, London.
Kubaschewski, O., Evans, E. L. L., & Alcock, C. B. *Metallurgical Thermochemistry.* 4th ed. Pergamon.
Levenspiel, O. *Chemical Reaction Engineering.* Wiley.
Schuhmann, R. *Metallurgical Engineering.* Vol. 1. Addison-Wesley.
Scully, J. C. *Fundamentals of Corrosion.* Pergamon.
Shewman, P. G. *Diffusion in Solids.* McGraw-Hill.
Shewman, P. G. *Transformations in Metals.* McGraw-Hill.
Shreir, L. L. ed. *Corrosion.* Vols. 1 and 2. Newnes.
Smallman, R. E. *Modern Physical Metallurgy.* Butterworths.
Stewart, D. & Tulloch, D. S. *Principles of Corrosion and Protection.* Macmillan.
Tetelmann, A. S. & McElivy, A. J. *The Fracture of Structural Materials.* Wiley.
Wagner, C. *Thermodynamics of Alloys.* Addison-Wesley.

4.0121 Metallurgy IIA

Comprises sections (*a*), (*b*) (part only), (*c*) and (*e*) of 4.012 Metallurgy II, together with appropriate laboratory work.

4.0122 Metallurgy IIB

Comprises section (*b*) (part only), (*d*), (*f*) and (*g*) of 4.012 Metallurgy II, together with:

(*i*) *Industrial Metallurgy*—A course of lectures on the application of metallurgical principles to industrial practice.

(*j*) *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.

PRINCIPAL REFERENCE BOOKS

As for 4.011 Metallurgy I, together with—

Hinsley, J. F. *Non-Destructive Testing.* Macdonald and Evans.
Kondic, V. *Metallurgical Principles of Founding.* Arnold.
Udin, H., Funk, E. R. & Wulff, J. *Welding for Engineers.* Wiley.

4.0123 Metallurgy IIC

Principally industrial metallurgy, and substantially as for section (*i*) 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

(*a*) 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 radiation damage; X-ray and neutron diffraction; phase transformations; fracture mechanisms; and the design of engineering materials.

(*b*) 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.

(*c*) Seminar.

TEXTBOOKS

As for 4.011 Metallurgy I and 4.012 Metallurgy II.

PRINCIPAL REFERENCE BOOKS

As for 4.011 Metallurgy I and 4.012 Metallurgy II, plus

Bloom, H. *The Chemistry of Molten Salts.* Benjamin.

Christian, J. W. *Theory of Transformations in Metals and Alloys.* Pergamon.

Denbigh, K. G. *The Thermodynamics of the Steady State.* Methuen.

de Groot, S. R. *Thermodynamics of Irreversible Processes.* North Holland.

Greenwood, N. N. *Ionic Crystals, Lattice Defects and Non Stoichiometry.* Butterworths.

Hills, A. W .D. ed. *Heat and Mass Transfer in Process Metallurgy.* I.M.M., London.

Hills, A. W. D. ed *Advances in Extractive Metallurgy.* I.M.M., London.

Hinsley, J. F. *Non-Destructive Testing.* Macdonald & Evans.

Kofstad, P. P. *Non Stoichiometry, Diffusion and Electrical Conductivity in Binary Metal Oxides.* Wiley Interscience.

Kondic, V. *Metallurgical Principles of Founding.* Arnold.

Udin, H., Funk, E. R. & Wulff, J. *Welding for Engineers.* Wiley.

4.021 Metallurgy Project

An experimental investigation of some aspect of metallurgy.

4.031 Physics of Metals

(a) *Statistical Mechanics:* Specification of systems and ensemble; quantised system. Distribution law for localised elements; microscopic states; Stirling's approximation; partition function; Bose-Einstein distribution; Fermi-Dirac distribution; Maxwell-Boltzmann distribution. Interpretation of classical thermodynamic variables; Monte Carlo methods.

(b) *Electron Theory:* Introduction. Dual nature of light and electrons. Wave equation; time-dependent, time-independent; tunnelling. Bonding. Mention of hydrogen atom; hydrogen molecule; ionic structure. Metallic bond; Drude-Lorentz theory, Sommerfeld theory; interaction with lattice; Kronig-Penny model. Suitable wave functions in metals; Bloch waves. Zone representations in k space; Fermi surface; experimental methods of determining Fermi surface. Fermi surface in liquids and alloys.

(c) *Interaction of Radiation with Matter:* Properties of electrons; photons, neutrons. Mass; charge; spin; energy. Energy transfers in collisions with free and bound particles. Absorption; true absorption; scattering. Importance of absorption mechanisms at different energies. Coherently scattered radiation; interference; Bragg's law; reference to dynamical theory and effects; determination of lattice parameters.

4.041 Mathematical Methods

Part 1. *10.351 Statistics SM* (see University Calendar).

Part 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.

4.121 Principles of Metal Extraction

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

TEXTBOOKS

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

4.131 Principles of Physical and Mechanical Metallurgy

A condensed treatment of physical and mechanical metallurgy.

4.141 Experimental Techniques in Physical Metallurgy

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

4.911 Materials Science

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

Wulff, J. ed. *Structure and Properties of Materials*. Vols. I & III. Wiley.

4.913 Materials Science

The structure and properties of crystalline substances. Crystal structures, crystal planes and directions. Examination of crystals by X-ray, electron and neutron diffraction techniques. The properties of crystalline solids. Defect structure of crystals. Influence of defects on the behaviour of crystals. The properties of metals and metallic alloys in terms of modern theories. The development of alloys for specific engineering applications. The elastic and plastic properties of solids. The mechanisms of fracture in crystalline solids. Ductile and brittle fracture. Creep. Fatigue. Design of materials.

Polymer materials. The structure and properties of polymers. Mechanisms for the modification of properties.

Ceramic materials. The structure and properties of ceramics. Similarities and differences with other crystalline solids. Ceramic-metal composites.

4.921 Materials Science

(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.

TEXTBOOKS

As for 4.911 Materials Science, together with—
Wulff, J. ed. *Structure and Properties of Materials.* Vol. IV. Wiley.

4.931 Metallurgy

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.

TEXTBOOKS

Guy, A. G. *Elements of Physical Metallurgy.* Addison-Wesley.
Wulff, J. ed. *Structure and Properties of Materials.* Vols. I and III. Wiley

4.941 Metallurgy for Engineers

The structure and properties of solids, with special reference to metals and metallic alloys which are of use to the engineer.

TEXTBOOKS

Barrett, C. R. *The Principles of Engineering Materials.* Prentice-Hall.
Guy, A. G. *Elements of Physical Metallurgy.* Addison-Wesley.

4.951 Materials Technology

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 electrodeposits; electrochemical protection.

The structure, properties and technology of wood.

METALLURGY GRADUATE COURSE SUBJECTS

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 in advanced techniques including the following: (a) X-ray metallography; (b) electron microscopy; (c) electron probe microanalysis; (d) quantitative metallography; (e) stress and strain analysis; (f) fracture toughness testing; (g) metal melting and casting; (h) mechanical testing; (i) electrochemical technique; (j) research techniques—physical; (k) research techniques—chemical; and (l) mineral investigation techniques.

4.231G Specialist Lectures in Advanced Theoretical Metallurgy

Advanced courses covering 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

5.010 Engineering A

Prerequisite: None.

Engineering Mechanics I: 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

Svensson, N. L. *Introduction to Engineering Design.* N.S.W.U.P.
Walshaw, A. C. *SI Units in Worked Examples.* Longman.

PRINCIPAL REFERENCE BOOKS

Beer, F. P. & Johnston, E. R. *Statics and Dynamics.* Vector ed. McGraw-Hill.
Harrisberger, L. *Engineersmanship.* Wadsworth.
Krick, E. V. *Introduction to Engineering and Engineering Design.* Wiley.
Meriam, J. L. *Statics and Dynamics.* Wiley.

5.020 Engineering B

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.

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.

TEXTBOOK

Karbowiak, A. E. & Huey, R. M. eds. *Information Computers, Machines and Man.* N.S.W.U.P.

PRINCIPAL REFERENCE BOOKS

Beer, F. P. & Johnston, E. R. *Statics and Dynamics.* Vector ed. McGraw-Hill.
Meriam, J. L. *Statics and Dynamics.* Wiley.

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.

TEXTBOOKS

Robertson, R. G. *Descriptive Geometry*. Pitman.
Thomson, R. *Exercises in Graphic Communication*. Nelson.
*Karbowiak, A. E. & Huey, R. M. eds. *Information, Computers, Machines and Man*. Wiley.

* For Introduction to Systems and Computers.

5.071 Engineering Analysis

Prerequisite: 10.022.

Digital Computer Programming: Numerical Methods — Roots of non-linear equations. Systems of linear equations. Finite differences; numerical differentiation and integration. Solution of ordinary differential equations — series and stepwise methods. Solution of partial differential equations — finite difference and iterative methods. Emphasis to be placed on the use of digital computers. *Statistics* — An introduction to probability theory. Random variables and distribution functions; the binomial, Poisson and normal distributions in particular. Standard sampling distributions, including those of χ^2, t and F. Estimation by moments and maximum likelihood: Confidence interval estimation. The standard tests of significance based on the above distributions, with a discussion of power where appropriate. An introduction to linear regression.

TEXTBOOKS

Freund, J. E. *Mathematical Statistics.* Prentice-Hall.
Statistical Tables.

PRINCIPAL REFERENCE BOOKS

Derman, C. & Klein, M. *Probability and Statistical Inference for Engineers.* O.U.P.
Freeman, H. *Introduction to Statistical Inferences.* Addison-Wesley.
Hald, A. *Statistical Theory with Engineering Applications.* Wiley.
Nielsen, K. L. *Methods in Numerical Analysis.* Macmillan.
Plumb, S. C. *Introduction to Fortran Programming.* McGraw-Hill.
Smith, G. D. *Numerical Solution of Partial Differential Equations.* O.U.P., 1974.
Southworth, R. W. & De Leeuw, S. L. *Digital Computation and Numerical Methods.* McGraw-Hill.

5.111 Mechanical Engineering Design I

Prerequisite: 5.010. Co-or prerequisite: 5.311.

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.

TEXTBOOKS

Australian Standard Engineering Drawing Practice. I.E. Aust., 1973.
Grant, H. E. *Engineering Drawing with Creative Design.* McGraw-Hill.
Shigley, J. E. *Mechanical Engineering Design.* 2nd ed. McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

De Garmo, E. P. *Materials and Processes in Manufacturing.* Macmillan.
Faires, V. M. *Design of Machine Elements.* Collier-Macmillan.

5.311 Engineering Mechanics

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.

PRINCIPAL REFERENCE BOOKS

Beer, F. P. & Johnston, E. *Mechanics for Engineers: Dynamics.* Vector ed. McGraw-Hill.
Higdon, A. & Stiles, W. B. *Engineering Mechanics.* Vector ed. Prentice-Hall.
Waldron, K. J. *Engineering Mechanics.* Wiley.

5.331 Dynamics of Machines I

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.

TEXTBOOKS

Hirschhorn, J. *Dynamics of Machinery,* Nelson.
Morrison, J. L. M. & Crossland, B. *Mechanics of Machines.* Longman.

PRINCIPAL REFERENCE BOOKS

Church, A. H. *Mechanical Vibrations.* Wiley.
Mabie, H. H. & Ocvirk, V. W. *Mechanics and Dynamics of Machinery.* Wiley.
Merrit, H. E. *Gear Engineering.* Pitman.

5.611 Fluid Mechanics/Thermodynamics I

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

Streeter, V. L. *Fluid Mechanics.* 4th ed. McGraw-Hill *or*
Massey, B. S. *Mechanics of Fluids.* Van Nostrand.
Wark, K. *Thermodynamics.* 2nd ed. McGraw-Hill, 1971, *or*
Lee, J. F., & Sears, F. W. *Thermodynamics.* 2nd ed. Addison-Wesley.
Reynolds, W. *Thermodynamics.* 2nd ed. McGraw-Hill, 1968.

5.711 Thermodynamics

Prerequisites: 1.001, 5.010, 5.020, 10.001.

The system; work and heat interactions. Properties of pure substances. First law of thermodynamics. Steady flow processes. Second law of thermodynamics. Power and refrigeration cycles; air standard cycles.

TEXTBOOK

Van Wylen, G. J. *Thermodynamics.* SI Unit ed. Wiley.

SCHOOL OF ELECTRICAL ENGINEERING

6.801 Electrical Engineering

Prerequisite: 1.001 Physics I.

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 interdisciplinary applications-orientated project.

Section A (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.

PRINCIPAL REFERENCE BOOKS

Del Toro, V. *Electrical Engineering Fundamentals.* Prentice-Hall.
Doebelin, E. O. *Measurement Systems: Application and Design.* McGraw-Hill.
Malstadt, H. V. & Enke, C. G. *Electronic Measurements for Scientists.* Benjamin.
Norton, H. N. *Handbook of Transducers for Electronic Measuring Systems.* Prentice-Hall.
Spitzer, F. & Howarth, B. *Principles of Modern Instrumentation.* Holt, Rinehart & Winston.
Vassos, B. H. & Ewing, G. W. *Analog and Digital Electronics for Scientists.* Wiley-Interscience.
Wightman, E. J. *Instrumentation in Process Control.* Butterworths.

Section B (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.

PRINCIPAL REFERENCE BOOKS

Colton, H. & Barber, H. *The Transmission and Distribution of Electrical Energy.* E.U.P.
Del Toro, V. *Electrical Engineering Fundamentals.* Prentice-Hall.
Fitzgerald, A. E. & Kingsley, C. *Electric Machinery.* 1st ed. only McGraw-Hill.
Fitzgerald, A. E., Higginbotham, S. M. & Graybel, A. *Basic Electrical Engineering.* 3rd ed. McGraw-Hill.
Kosow, I. L. *Control of Electrical Machines.* Prentice-Hall.
McGuinness, W. J. & Stein, B. *Mechanical and Electrical Equipment for Buildings.* 5th ed. Wiley.

SCHOOL OF MINING ENGINEERING

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 assistances and controls. Tutorial exercises.

Part 2: Investment, employment, wages, basic mining costs. International developments, pattern of mineral trade. Environmental requirements, conservation. Tutorial exercises.

TEXTBOOKS

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 or visits to plants.

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, elements of mine design as influenced by the system. Orebody types and classification, 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. Integrated mining methods, pillar recovery. Parameters for applicability and efficiency of mining methods. Mining waste disposal.

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.

TEXTBOOKS

Calhoun, J. C. *Fundamentals of Reservoir Engineering.* Univ. Oklahoma Press, 1957.
Lewis, R. S. & Clark, G. B. *Elements of Mining.* Wiley, *or*
Pfleider, E. P. & Eugen, D. *Surface Mining.* A.I.M.E.
Sinclair, J. *Winning Coal.* Pitman.
Woodruff, S. D. *Methods of Working Coal and Metal Mines.* 3 vols., Pergamon.

PRINCIPAL REFERENCE BOOKS

STATISTICS

Deming, W. E. *Some Theory of Sampling.* Wiley.

DRILLING

Brantly, J. E. *Rotary Drilling Handbook.* Palmer Publications.
Cumming, J. D. *Diamond Drill Handbook.* Smith.

GEOPHYSICS

Dobrin, M. R. *Introduction to Geophysical Prospecting.* McGraw-Hill.

EXPLOSIVES & BLASTING

Langefors, U. & Kohlstrom, B. *Rock Blasting.* 2nd ed. Wiley.

MINE EQUIPMENT

Bryson, T. *Mining Machinery.* Pitman.

MINING PRACTICE

Morrison, R. G. R. *A Philosophy of Ground Control.* Ontario Dept. of Mines, 1970.
Shevyakov, L. *Mining of Mineral Deposits.* Peace Publishers.
Stoces, B. *Atlas of Mining Methods.* 2 vols. Pergamon.
Whitaker, J. W. & Willet, H. L. *Colliery Explosion and Recovery Work.* Pitman.

5th Empire Mining and Metallurgical Congress. *Mining Methods in Australia and Adjacent Territories.* A.I.M.M., 1953.
8th Commonwealth Mining and Metallurgical Congress. *The Australian Mining, Metallurgical and Mineral Industry.* A.I.M.M., 1965.

TUNNELLING

Inst. of Min. Met. London. *Symposium on Shaft Sinking and Tunnelling, 1959.*
Proctor, R. V. & White, T. L. *Rock Tunnelling with Steel Supports.* Commercial Shearing and Stamping Company.

ALLUVIAL MINING

Griffith, S. V. *Alluvial Prospecting and Mining.* Pergamon, 1960.
Harrison, H. L. M. *Examination, Boring and Valuation of Alluvial Deposits.* Min. Pubs., London.
Inst. Min. & Met. Symposium on Open Cast Mining, Quarrying and Alluvial Mining. Min. Pubs., London, 1964.
Macdonald, E. H. *Manual of Beach Mining Practice.* 2nd ed. Aust. Govt. Pub. Service, 1973.

OIL AND NATURAL GAS

Katz, J. *Handbook of Natural Gas Engineering.* McGraw-Hill, 1959.
Uren, L. C. *Petroleum Production Engineering.* Vol. I *Oil Field Exploitation.* Vol. II *Development.* Vol. III *Economics.* McGraw-Hill.

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, fan laws, introductory thermodynamics. Natural ventilation. Bulk materials handling underground, hoisting, conveyors, tracked and trackless transport, wire ropes, oil and slurry pipe lines. Natural state of stress in rock masses, stress concentration around underground openings.

2. Support at the face, in roadways and in the waste. Requirements of Mines Inspection Acts with respect to electrical power distribution, power supply and transmission. Mine drainage, pumps, pump station, flooding and de-watering. Mine safety, health, metallic poisons, hygiene, diseases, forensic investigations. Noise control in mining operations. 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. To a lesser degree some topics from 7.134 and 7.144 may also be included or recommended for additional reading.

PRINCIPAL REFERENCE BOOKS

HOISTING

Broughton, H. H. *Electric Winders.* Sun.
Price, A. G. *Winding Calculations for the Mining Engineer.* The Gen. Elec. Co.

MINE VENTILATION

Buffalo Forge Co. *Fan Engineering.*
BSS 848. *Testing of Fans.*
Hartman, H. L. *Mine Ventilation and Air Conditioning.* Ronald Press.
Rayner, H. E. R. *A Guide to Mine Ventilation Calculations.* Mine Ventilation Soc. of South Africa.
Transvaal Chamber of Mines. *Quality of Mine Air.*

ECONOMICS

Myer, J. N. *Financial Statement Analysis.* Prentice-Hall.
Wilcox, F. *Mine Accounting and Financial Administration.* Pitman.

MINING LAW

Mining Acts. N.S.W., W.A., Tas., Q'land, Vic. & S.A.

SAFETY, HEALTH

Davies, C. N. *Dust is Dangerous.* Faber & Faber.
Gill, G. H. *Dust, Its Effects on the Respiratory System.* Lewis.
Jenkins, J. D. & Waltham, J. W. *Coal Mines Rescue and Fire Fighting.* Griffin.
McAdam, R. & Davidson, D. *Mine Rescue Work.* Oliver & Boyd.

MINING PRACTICE

Mitke, C. A. *Mining Methods.* McGraw-Hill.
Peele, R. *Mining Engineers Handbook.* Wiley.
Spruth, Fritz. *Face Supports in Steel and Light Metal.* Colliery Guardian.

ROCK MECHANICS

Jaeger, J. C. & Cook, N. G. W. *Fundamentals of Rock Mechanics.* Methuen, 1969.
Subsidence Engineer's Handbook. N.C.B. Prod. Dept. London.

7.134 Mining Engineering III

Review of rock fragmentation and rapid excavation, nuclear blasting applied to mining, oil reservoir mechanics, pressure, temperature and phase behaviour, sea-floor excavation, advanced composite mining techniques for coal and metalliferous deposits with particular reference to mechanization and retreating methods, computer applications to mining methods and transport.

PRINCIPAL REFERENCE BOOKS

Katz, J. *Handbook of Natural Gas Engineering.* McGraw-Hill, 1959.
Mero, M. *Mineral Resources of the Sea.* Pergamon.

7.144 Mining Engineering IV

Advanced mine ventilation, network analysis, mine thermodynamics, air flow in naturally and fan ventilated mines. Booster and auxiliary fans. 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.

TEXTBOOK

Jaeger, J. C. & Cook, N. G. W. *Fundamentals of Rock Mechanics.* Methuen, 1969.

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 U.P., 1964.
or
Winiberg, F. *Metalliferous Mine Surveying.* 5th ed. Min. Pub. Ltd., 1966.
or
Metcalfe, J. E. *A Mining Engineer's Survey Manual.* Electrical Press, London.

7.224 Mine Valuation

Administration. 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, technology of crushing and grinding, particle size distribution and analysis. Gravity concentration and other physical methods of separation. Froth flotation. Chemical processing and extraction. In situ recovery processes. Coal preparation technology. 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.

PRINCIPAL REFERENCE BOOKS

Cameron, E. N. *Ore Microscopy.* Wiley.
Gaudin, A. M. *Flotation.* 2nd ed. McGraw-Hill.
Glembotskii, V. A. *Flotation.* Primary Sources. N.Y.
Leonard, J. W. & Mitchell, D. R. *Coal Preparation.* A.I.M.E.
Sutherland, K. L. & Wark, I. W. *Principles of Flotation.* A.I.M.M.
Taggart, A. F. *Elements of Ore Dressing.* Wiley.

7.316R Mineral Processing II

Physical and chemical properties of minerals. Applied mineragraphy. Selection of beneficiation processes. Gravity separation processes and 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 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.* A.I.M.E.

PRINCIPAL REFERENCE BOOK

Short, M. W. *Microscopic Determination of Ore Minerals.* U.S. Dept. Int.

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.

TEXT AND PRINCIPAL REFERENCE BOOKS

Students should obtain list from Broken Hill.

7.414 Mineral Industry Elective Project

The elective project may be selected from one of the following options, and consists of Part 1: Literature survey, and Part 2: Thesis.

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, general case, 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. *Marine Mining*

Basic oceanography, physical resources of the ocean, marine deposits and characteristics, marine physiology. Sampling techniques, hydrographic surveying, navigation. Mining systems, excavation, transport, support platforms, treatment and tailings disposal. Marine environment, air-sea interface, water zones, sea-floor and sub-bottom.

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. Pipelining and 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 networking. 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 classification, placement of mixed fills.

9. *Advanced Rock Mechanics*

Methods of stress and strain analysis. Theories of rock failure. Photoelasticity. 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. Part 1: Literature Survey. Part 2: Thesis.

MINING AND MINERAL ENGINEERING GRADUATE SUBJECTS

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 pressure around mine workings. Ground control and methods of support in the workings and the waste. Design of mining excavations. Slope stability.

6. Subsidence phenomena associated with mine workings. Methods of working and design of structures to minimize damage.

7.132G Mining Engineering Laboratory

A selection of advanced laboratory 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

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 mass 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.

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.

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

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 mine ventilation, sources of heat in mines, geothermal gradients, mine 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 technology, 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 flowsheets. 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 Beneficiation

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, 1969.
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 and 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.

SCHOOL OF CIVIL ENGINEERING

8.112 Materials and Structures

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.

8.151 Mechanics of Solids

Statics of bars. Geometrical properties of plane figures. Stress and strain; uniaxial stress. Stresses and deformations due to bending, shear and torsion. Stress and strain at a point; combined stresses. Assemblages of bars and beams. Structural instability. Dynamic loading.

TEXTBOOK

Hall, A. S. *An Introduction to Mechanics of Solids.* SI ed. Wiley, 1973.

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, 1966.

8.259 Properties of Materials

8.250—Properties of Materials, *plus* the structure and properties of binary alloys; control of structure and properties, commercial alloys, materials selection.

8.510 Hydraulics

Fluid properties; hydrostatics, stability of floating bodies; fluid acceleration; flow patterns, continuity; Euler, Bernoulli, energy and momentum equations. Laboratory experiments.

TEXTBOOKS

Giles, R. V. *Fluid Mechanics and Hydraulics.* Schaum's Outline Series.
Vennard, J. K. *Elementary Fluid Mechanics.* 4th ed. Wiley, 1961.

CIVIL ENGINEERING GRADUATE SUBJECTS

8.757G Foundation Engineering*

Bearing capacity and settlement of cohesive and cohesiveless soils, shallow and deep foundations, pile and raft foundation interaction, vibration of foundations, accelerated consolidation.

8.842G Groundwater Hydrology

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

* Not available in 1975.

SCHOOL OF WOOL AND PASTORAL SCIENCES

9.121 Livestock Production I

The sheep and beef cattle industries and their place in the economic life of Australia; levels of production and trends. The interrelationships of each of these classes of livestock and the natural, artificial and economic conditions influencing production. Sheep producing zones. Sheep breeds, their uses and economic relationships. Crossbreeding, prime lamb production.

Sheep management; and principal sources of wastage.

TEXTBOOKS

Alexander, G. & Williams, O. B. *The Pastoral Industries of Australia.* Sydney U.P.
Cole, V. G. *Sheep Management for Wool Production.* Grazcos.
James, B. J. F. ed. *Animal Reproduction.* Cheshire.

PRINCIPAL REFERENCE BOOKS

Austen, H. B. *The Merino. Past, Present and Probable.* A. & R.
Belschner, H. G. *Sheep Management and Diseases.* 8th ed. A. & R.
Dun, R. B. & Eastoe, R. D. *Science and the Merino Breeder.* N.S.W. Govt. Printer.
Hafez, E. S. E. ed. *Reproduction in Farm Animals.* 2nd ed. Lea & Febiger.
Moore, R. M. ed. *Australian Grasslands,* A.N.U.P.
Tribe, D. E. & Coles, G. J. R. *Prime Lamb Production.* Cheshire.

9.122 Livestock Production II

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.

PRINCIPAL REFERENCE BOOKS

Barton, R. A. *Quality Beef Production.* Massey Agricultural College.
Fraser, A. *Beef Cattle Husbandry.* Crosby Lockwood.
Neuman, A. L. & Snapp, R. R. *Beef Cattle.* 6th ed. Wiley.
Payne, W. J. A. *Cattle Production in the Tropics.* 2 vols. Longman.
Yeates, N. T. M. *Modern Aspects of Livestock Production.* Butterworths.
Yeates, N. T. M. & Schmidt, P. J. *Beef Cattle Production.* Butterworths.

9.123 Livestock Production III

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.

PRINCIPAL REFERENCE BOOKS

Krider, J. L. & Carroll, W. E. *Swine Production*. McGraw-Hill.
Roy, J. H. B. *The Calf. Vol. 1. Management and Feeding*. Butterworths.
Roy, J. H. B. *The Calf. Vol. 2. Nutrition and Health*. Butterworths.

9.124 Livestock Production IV

Principles of livestock production and their application in optimizing animal production; reproduction and fertility; applied milk secretion; 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. *Carcase Composition and Appraisal of Meat Animals*. C.S.I.R.O.

PRINCIPAL REFERENCE BOOKS

American Meat Inst. Foundation. *Science of Meat and Meat Products*. 2nd ed. Freeman.
Barton, R. A. *Quality Beef*.
Butterfield, R. M. & May, N. D. S. *Muscles of the Ox*. Q'ld. U.P.
Gerrard, F. *Meat Technology*. Leonard Hill.
Hafez, E. S. E. *Behaviour of Domestic Animals*. Lea & Febiger.
Hafez, E. S. E. & Dyer, I. A. *Animal Growth and Nutrition*. Lea & Febiger.
Lodge, G. A. & Lamming, G. E. *Growth and Development of Mammals*. Butterworths.
Rhodes, D. N. ed. *Meat Production from Entire Male Animals*. Churchill.

9.131 Animal Health and Preventive Medicine I

Causes of disease. Symptomatology and recognition of the abnormal state; Nutritional conditions and digestive disorders; Deficiences; 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

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 programmes. Management and parasites (parasites on pasture). Treatment and control. Parasite identification. Cattle diseases.

9.221 Agronomy

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

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.* M.U.P.
Donahue, R. L. *Soils.* Prentice-Hall.
Leeper, C. W. *Introduction to Soil Science.* M.U.P.
Molnar, I. ed. *Manual of Australian Agriculture.* 2nd ed. Heinemann.
Spedding, C. R. *Grassland Ecology.* O.U.P.
Whittet, J. N. *Weeds.* N.S.W. Dept. of Agriculture.
Wilson, B. *Pasture Improvement in Australia.* Murray.

9.232 Crop Agronomy

Field crop production associated with the pastoral industries. Pasture seed production. Crop physiology. Cropping practices. Pests and diseases.

9.311 Agricultural Economics I

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, N.Y. 1958.
Heady, E. O. *Economics of Agricultural Production and Resource Use.* Prentice-Hall, N.J. 1952.

Samuelson, P. A., Hancock, K., & Wallace, R. *Economics: Australian Edition.* McGraw-Hill, Sydney, 1970.

PRINCIPAL REFERENCE BOOK

Hardaker, J. B., Lewis, J. N. & McFarlane, G. C. *Farm Management and Agricultural Economics.* A. & R., 1970.

9.312 Agricultural Economics II

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 U.P., 1967.

9.313 Farm Management I

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, N.Y. 1962.

Joint Committee on Standardisation of Farm Management Accounting. *Accounting and Planning for Farm Management.* Dept. Primary Industries, Brisbane. 1966.

Meredith, G. G., Rickards, P. A. & Pearse, R. A. *Farm Management Accounting: A Commentary.*

Professional Farm Management Guidebook, No. 4, 2nd ed. U.N.E., Armidale. 1969.

Rickards, P. A. & McConnell, D. J. *Budgeting, Gross Margins & Programming for Farm Planning.* Professional Farm Management Guidebook No. 3, U.N.E., Armidale. 1967.

9.314 Farm Management II

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, 1967.

Heady, E. O. & Candler, W. *Linear Programming Methods.* Iowa State U.P., 1958.

Throsby, C. D. *Elementary Linear Programming.* Random House, 1970.

9.315 Farm Management III

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, 1971.

Dillon, J. L. *The Analysis of Response in Crop & Livestock Production.* Pergamon, 1968.

Heady, E. O. & Dillon, J. L. *Agricultural Production Functions.* Iowa State U.P., 1961.

PRINCIPAL REFERENCE BOOKS

Baum, E. L., Heady, E. O. & Blackmore, J. eds. *Methodological Procedures in the Economic Analysis of Fertiliser Use Data.* Iowa State U.P., 1956.

Heady, E. O., Johnson, G. L. & Hardin, L. S. eds. *Resource Productivity, Returns to Scale and Farm Size.* Iowa State U.P., 1956.

Naylor, T. H., Balintfy, J. L., Burdick, D. S. & Chu, K. *Computer Simulation Techniques.* Wiley, 1966.

9.316 Analysis of Rural Development Projects

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 techniques. 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, 1966.

Davidson, B. R. *The Northern Myth.* M.U.P., 1965.

Eckstein, O. *Water Resources Development.* Harv. U.P., 1958.

Hinrichs, H. H. & Taylor, G. M. *Program Budgeting and Benefit Cost Analysis.* Goodyear, 1969.

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, 1958.
Mishaw, E. J. *Cost Benefit Analysis.* Allen & Unwin, 1971.
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. U.S. Govt. Printer, 1950.

9.411 Agricultural Chemistry I

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

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. Insectides, 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

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, 1956.
Dougherty, R. W. et al. *Physiology of Digestion in the Ruminant.* Butterworths, 1965.
Maynard, L. A. *Animal Nutrition.* McGraw-Hill, 1947.

9.531 Wool Technology I

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.

PRINCIPAL REFERENCE BOOK

Ryder, M. L. & Stephenson, S. K. *Wool Growth.* Academic.

9.532 Wool Technology II

Practical wool sorting, wool classing and appraisal. Modified classing in relation to presale testing and sale by sample. The physical handling and composition of the Australian clip.

TEXTBOOK

Dawes, K. *Objective Measurement of Wool.* N.S.W.U.P.

9.533 Wool Technology III

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.*

PRINCIPAL REFERENCE BOOK

Onions, W. J. *Wool: an Introduction to its Properties, Varieties, Uses and Production.* Benn, 1962.

9.534 Wool Technology IV

Raw Materials: Fibres other than wool; their properties, uses and identification.

9.535 Wool Technology V

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.* N.S.W.U.P.

9.536 Wool Technology VI

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, 1961.

PRINCIPAL REFERENCE BOOK

Alexander, P. & Hudson, R. F. *Wool: its Chemistry and Physics.* 2nd ed. Chapman & Hall.

9.601 Animal Physiology I

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. O.U.P.

PRINCIPAL REFERENCE BOOKS

Benzie, D. & Phillipson, A. *The Alimentary Tract of the Ruminant.* Oliver & Boyd.
Breazile, J. E. *Textbook of Veterinary Physiology.* Lea & Febiger.
Best, C. H. & Taylor, L. B. *Physiological Basis of Medical Practice.*
Catt, K. J. *An A.B.C. of Endocrinology.* The Lancet.
Turner, C. D. & Bagnara, J. T. *General Endocrinology.* Saunders.

9.602 Animal Physiology II

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.

PRINCIPAL REFERENCE BOOKS

Blandau, R. J. ed. *The Biology of the Blastocyst.* Chicago U.P.
Cowie, A. T. & Tindal, J. S. *The Physiology of Lactation.* Arnold.
Harris, G. W. & Donovan, B. T. eds. *The Pituitary Gland.* 3 vols. Butterworths.
Haymaker, W. *The Hypothalamus.* C. C. Thomas.
Johnson, A. D., Gomes, W. R. & Vandemark, N. L. *The Testis.* Academic.
McKerns, K. W. ed. *The Gonads.* North Holland.

9.603 Animal Physiology III

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 mamalian 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., and Cupps, P. T. eds. *Reproduction in Domestic Animals.* 2nd ed. Academic, 1969.
Donovan, B. T. *Mammalian Neuroendocrinology.* McGraw-Hill.
Sampson Wright. *Applied Physiology.* 10th ed. O.U.P., 1961.

PRINCIPAL REFERENCE BOOKS

As for 9.602.

9.801 Genetics I

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, 1960.
Fraser, A. S. *Heredity, Genes and Chromosomes.* McGraw-Hill, 1966.

PRINCIPAL REFERENCE BOOKS

Dun, R. B. & Eastoe, R. D. *Science and the Merino Breeder.* N.S.W. Govt. Printer.
Lerner, I. M. *Population Genetics and Animal Improvement.* C.U.P.
Lerner, I. M. & Donald, H. P. *Modern Developments in Animal Breeding.* Academic.
Snedecor, G. W. & Cochran, W. G. *Statistical Methods.* 6th ed. Iowa State U.P.

9.802 Genetics II

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.

PRINCIPAL REFERENCE BOOKS

Crow, J. F. & Kimura, M. *Introduction to Population Genetics Theory.* Harper & Row.
Lerner, I. M. *Genetic Basis of Selection.* Wiley.
Pirchner, F. *Population Genetics in Animal Breeding.* Freeman.
Turner, H. N. & Young, S. S. Y. *Quantitative Genetics in Sheep Breeding.* Macmillan.

9.811 Biostatistics

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. and Cochran, W. G. *Statistical Methods.* 6th ed. Iowa State U.P.

PRINCIPAL REFERENCE BOOKS

Cochran, W. G. & Cox, G. M. *Experimental Designs.* 2nd ed. Wiley.
Cox, D. R. *Planning of Experiments.* Wiley.
Pearce, S. C. *Biological Statistics.* McGraw-Hill.
Sokal, R. R. & Rohlf, F. J. *Biometry.* Freeman.
Steel, R. G. D. & Torrie, J. H. *Principles and Procedures of Statistics.* McGraw-Hill.

9.901 Rural Extension

Objective and agencies. Research-extension relationships. Educational, psychological and sociological aspects and principles. Programme planning involving analysis of the situation, determination of objectives, establishment of priorities and assessment of rural-socio-economic factors. Presentation of programmes including aims, educational procedures in presentation, channels and techniques. Evaluation of extension.

TEXTBOOK

Rogers, E. M. *Diffusion of Innovations.* Collier Macmillan, 1962.

PRINCIPAL REFERENCE BOOKS

Bettinghaus, E. P. *Persuasive Communication.* Holt, Rinehart & Winston.
Emery, F. M. & Oeser, O. A. *Information Decision and Action.* M.U.P.
Lionberger, H. F. *Adoption of New Ideas and Practices.* Iowa State U.P.

WOOL TECHNOLOGY GRADUATE SUBJECTS

9.105G Advanced Livestock Production

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

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 Board types and valuation.

9.711G Advanced Wool Technology

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.

PRINCIPAL REFERENCE BOOK

Onions, W. J. *Wool: an Introduction to its Properties, Varieties, Uses and Production.* Benn, 1962.

9.902G Techniques of Laboratory and Field Investigation

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.

SCHOOL OF MATHEMATICS

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?* O.U.P.
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

Shields, P. C. *Elementary Linear Algebra.* 2nd ed. Worth.
Thomas, G. B. *Calculus and Analytic Geometry.* 4th ed. Addison-Wesley.

PRINCIPAL REFERENCE BOOKS

Blatt, J. M. *Basic Fortran IV Programming (IBM/360 Version).* Computer Systems (Aust.).
Campbell, H. F. *Matrices with Applications.* Appleton-Century-Crofts.
Cohn, P. M. *Solid Geometry.* Routledge & Kegan Paul.
Kaplan, W. & Lewis, D. J. *Calculus and Linear Algebra.* Vols 1 & 2. Wiley.
Kelly, G. M. *Introduction to Linear Algebra and Vector Geometry.* Reed Education, 1971.
Lange, I. H. *Elementary Linear Algebra.* Wiley.
Pedoe, D. *A Geometric Introduction to Linear Algebra.* Wiley.
Purcell, E. J. *Calculus With Analytic Geometry.* Appleton-Century-Crofts.
Smith, W. K. *Limits and Continuity.* Collier-Macmillan.
Tetra, B. C. *Basic Linear Algebra.* Harper & Row.
Zelinsky, D. *A First Course in Linear Algebra.* Academic.

10.011 Higher Mathematics I

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

PRELIMINARY READING TEST

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.* E.U.P.
Shields, P. C. *Elementary Linear Algebra.* 2nd ed. Worth.
Spivak, M. *Calculus.* Benjamin.

PRINCIPAL REFERENCE BOOKS

As for 10.001 plus:
Abraham, R. *Linear and Multilinear Algebra.* Benjamin.
Brauer, F. & Nohel, J. *Ordinary Differential Equations.* Benjamin.
Burkhill, J. C. *A First Course in Mathematical Analysis.* C.U.P.

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

Greening, M. G. *First Year General Mathematics*. N.S.W.U.P.
Youse, B. K. & Stalnaker, A. W. *Calculus for the Social and Natural Sciences*. International Textbook Co.

PRINCIPAL REFERENCE BOOKS

Burford, R. L. *Introduction to Finite Probability*. Merrill.
Christian, R. C. *Logic and Sets*. Blaisdell.
Hoyt, J. P. *A Brief Introduction to Probability Theory*. International Text Book Co.
Johnson, W. G. & Zaccaro, L. N. *Modern Introductory Mathematics*. McGraw-Hill.

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.

PRINCIPAL REFERENCE BOOKS

Hildebrand, F. B. *Advanced Calculus for Applications*. Prentice-Hall.
Kreyszig, E. *Advanced Engineering Mathematics*. Wiley.
Pipes, L. A. & Harvill, L. R. *Applied Mathematics for Engineers and Physicists*. 3rd ed. McGraw-Hill.
Spiegel, M. R. *Advanced Mathematics for Engineers and Scientists*. McGraw-Hill.

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

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.

PRINCIPAL REFERENCE BOOKS

Grove, W. E. *Brief Numerical Methods.* Prentice-Hall.
Hildebrand, F. B. *Advanced Calculus for Applications.* Prentice-Hall.
Pipes, L. A. & Harvill, L. R. *Applied Mathematics for Engineers and Physicists.* 3rd ed. McGraw-Hill.
Spiegel, M. R. *Advanced Mathematics for Engineers and Scientists.* McGraw-Hill.
Wylie, C. R. *Advanced Engineering Mathematics.* 3rd ed. McGraw-Hill.

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.

TEXTBOOK

Jeffreys, G. V. & Jenson, V. G. *Mathematical Methods in Chemical Engineering.* Academic.

PRINCIPAL REFERENCE BOOKS

Churchill, R. E. *Operational Mathematics.* McGraw-Hill.
Giles, E., Pretorius, W. J. & Prokhovnik, S. J. *Supplement to Mathematical Methods.* Science Press.
Hildebrand, F. B. *Advanced Calculus for Applications.* Prentice-Hall.
Keane, A. & Senior, S. A. eds. *Mathematical Methods.* 2nd ed. Science Press.
Kreyszig, E. *Advanced Engineering Mathematics.* Wiley.

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.

TEXTBOOKS

SESSION 1

Tropper, A. M. *Linear Algebra.* Nelson. Paperback.

SESSION 2

Gass, H. *Linear Programming.* I.S.E. McGraw-Hill.
Tropper, A. M. *Linear Algebra.* Nelson. Paperback.

PRINCIPAL REFERENCE BOOKS

Hoffman, K. & Kunze, R. *Linear Algebra.* Prentice-Hall.
Lang, S. *Linear Algebra.* Addison-Wesley.
Lipschutz, S. *Linear Algebra.* Schaum.

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.* I.S.E. McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Hilton, P. J. *Partial Derivatives.* Routledge.
Thomas, G. B. *Calculus and Analytic Geometry.* 4th ed. Addison-Wesley.

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: subgroups, quotient groups, isomorphisms, Lagrange's theorem, Sylow's theorem.

TEXTBOOKS

Clark, A. *Elements of Abstract Algebra.* Wadsworth, 1971.
Hoffman, K. & Kunze, R. *Linear Algebra.* Prentice-Hall.

PRINCIPAL REFERENCE BOOKS

Green, J. A. *Sets and Groups.* Macmillan.
Hall, M. *The Theory of Groups.* Macmillan.
Hartley, B. & Hawkes, T. O. *Rings, Modules and Linear Algebra.* Chapman & Hall.
Herstein, I. M. *Topics in Algebra.* Blaisdell.
Lang, S. *Linear Algebra.* W.S.S. Addison-Wesley.
Ledermann, W. *The Theory of Finite Groups.* Oliver & Boyd.

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.

TEXTBOOK

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.

PRINCIPAL REFERENCE BOOKS

Derrick, W. *Introductory Complex Analysis.* Academic.
Goldberg, R. R. *Methods of Real Analysis.* Blaisdell.
Knopp, K. *Elements of the Theory of Functions.* Dover.
Lang, S. *Calculus of Several Variables.* Addison-Wesley.
Spivak, M. *Calculus.* Benjamin.

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.

PRINCIPAL REFERENCE BOOKS

Betz, H., Burcham, P. B. & Ewing, G. M. *Differential Equations with Applications.* I.S.R. Harper.
Blatt, J. M. *Basic Fortran IV Programming.* Computer Systems (Aust.).
Dettman, J. W. *Mathematical Methods in Physics and Engineering.* McGraw-Hill.
Smith, G. D. *Vector Analysis Including the Dynamics of a Rigid Body.* O.U.P.

10.331 Statistics 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.

PRINCIPAL REFERENCE BOOKS

Bennett, C. A. & Franklin, N. L. *Statistical Analysis in Chemistry and the Chemical Industry.* Wiley.
Davies, O. L. *Statistical Methods in Research and Production.* Oliver & Boyd.
Steel, R. G. D. & Torrie, J. H. *Principles and Procedures of Statistics.* McGraw-Hill.

SCHOOL OF PSYCHOLOGY

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.

Part A—Theory

TEXTBOOKS

C.R.M. *Psychology Today*. 2nd ed. C.R.M., 1972.

Mednick, S. A., Pollio, H. R. & Loftus, E. F. *Learning*. 2nd ed. Prentice-Hall, 1973.

Kelly, E. L. *Assessment of Human Characteristics*. Brooks Cole, 1967.

Selected *Scientific American* reprints, as advised by the School.

The following is recommended as an additional text for intending honours students:

Hebb, D. O. *Textbook of Psychology*. 3rd ed. Saunders, 1972.

Part B—Practical

TEXTBOOK

Lumsden, J. *Elementary Statistical Method*. Univ. of W.A. Press, 1969.

SCHOOL OF TEXTILE TECHNOLOGY

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, worsted and woollen 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, 1961.

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 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, 1967.

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.

PRINCIPAL REFERENCE BOOKS FOR TEXTILE TECHNOLOGY I, II and III

Textile Testing

Brearley, A. & Cox, D. *An Outline of Statistical Methods for Use in the Textile Industry*. WIRA, Leeds, 1956.
Garner, J. W. *A Textile Laboratory Manual*. Nat. Trade Press, 1951.
Grover, E. B. & Hamby, D. S. *Handbook of Textile Testing and Quality Control*. Textile Book Publishers, 1960.
Hearle, J. W. S. & Peters, R. H. *Moisture in Textiles*. Textile Inst., Manchester & Butterworths, London, 1960.
Howell, H. G., Mieszkis, K. W. & Tabor, D. *Friction in Textiles*. Butterworths, 1959.
Kaswell, E. R. *Textile Fibres, Yarns and Fabrics*. Reinhold, 1953.
Koch, P. *Microscopic and Chemical Testing of Textiles*. Chapman & Hall, 1963.
Luniak, B. *Identification of Textile Fibres*. Pitman, 1953.
Morton, W. E. & Hearle, J. W. S. *Physical Properties of Textile Fibres*. Textile Inst., Manchester, 1962.
Identification of Textile Materials. Textile Inst., Manchester, 1965.
Methods of Test for Textiles. Brit. Standards Institution, 1963.
Physical Properties of Wool Fibres and Fabrics. Vol. 2. WIRA, Leeds, 1955.
Standards. Vols 24 and 25. Amer. Soc. for Testing & Materials. Philadelphia. Annual.
Technical Manual Test Methods. Amer. Assoc. of Textile Chemists & Colourists. Durham, Annual.
Testing and Control in the Wool Industry. Vol. 3. WIRA, Leeds, 1955.
Textile Institute Manual of Cotton Spinning. Vol. 2. Part 1. *The Characteristics of Raw Cotton*. Textile Inst., Manchester, 1955.
Textile Standards. Standards Assoc. of Aust.

Dyeing and Finishing

Beech, W. F. *Fibre Reactive Dyes*. Logos, London, 1970.
Bird, C. L. *The Theory and Practice of Wool Dyeing*. Soc. Dyers & Colourists, Bradford, 1963.
Crank, J. & Park, G. S. *Diffusion in Polymers*. Academic, 1968.
Giles, C. H. *Laboratory Course in Dyeing*. 2nd ed. Soc. Dyers & Colourists, Bradford, 1971.
Marsh, J. T. *Introduction to Textile Bleaching*. Chapman & Hall, 1956.
Marsh, J. T. *Introduction to Textile Finishing*. Chapman & Hall, London, 1966.
Marsh, J. T. *Mercerising*. Chapman & Hall, 1941.
Marsh, J. T. *Self Smoothing Fabrics*. Chapman & Hall, 1962.
Moilliet, J. L., Collie, B. & Black, W. *Surface Activity*. Spon, 1961.
Peters, R. H. *Textile Chemistry*. Vol. II. Elsevier, 1967.
Rys, P. & Zollinger, H. *Fundamentals of the Chemistry and Application of Dyes*. Wiley, 1970.
Schick, M. J. *Non-Ionic Surfactants*. Vols I & II. Arnold, 1967.
Schwarz, A. M. & Perry, J. W. *Surface Active Agents*. Intersci., 1958.
Trotman, E. R. *Dyeing and Chemical Technology of Textile Fibres*. 4th ed. Griffin, 1970.
Colour Index. 2nd ed. Soc. Dyers & Colourists, 1971.

Knitting

Chamberlain, J. *Knitting Mathematics and Mechanisms*. Coll. of Tech. & Commerce. Leicester, 1952.
Chamberlain, J. *Principles of Machine Knitting*. Textile Inst., Manchester, 1951.

Mills, R. W. *Fully Fashioned Garment Manufacture.* Cassell, 1965.
Paling, D. *Warp Knitting Technology.* 2nd ed. Columbine Press, 1965.
Reichman, C. ed. *Advanced Knitting Principles.* N.K.O.A., N.Y., 1964.
Reichman, C. ed. *Principles of Knitting Outerwear Fabrics and Garments.* N.K.O.A., N.Y., 1961.
Reisfeld, A. *Warp Knit Engineering.* N.K.O.A., N.Y., 1966.
Shinn, W. *Principles of Knitting.* Vols I and II. Clark Pub. Co., Charlotte, 1957.
Wignall, H. *Knitting.* Pitman, 1964.

Weaving

Aitken, J. B. *Automatic Weaving.* Columbine Press, 1964.
Bennett, G. A. *Introduction to Automatic Weaving.* Harlequin Press, 1948.
Crossland, A. *Modern Carpet Manufacture.* Columbine Press, 1958.
Duxbury, V. & Wray, G. R. *Modern Developments in Weaving Machinery.* Columbine Press, 1962.
Middlebrook, W. *Primary Aspects of the Power Loom.* Emmott, 1953.
Middlebrook, W. *Secondary Aspects of the Power Loom.* Emmott, 1956.
Robinson, A. T. C. *Rayon Fabric Construction.* Skinner, 1951.
Robinson, A. T. C. *Woven Cloth Construction.* Butterworths, 1967.
Seydel, P. V. *Warp Sizing.* Smith Pub. Co., 1958.
Watson, W. *Advanced Textile Design.* 3rd ed. Longman, 1955.
Watson, W. *Textile Design and Colour.* 6th ed. Longman, 1954.
Wright, R. W. *Modern Textile Design and Production.* Nat. Trade Press, 1949.

Yarn Manufacture

Griffin, T. F. *Practical Worsted Carding.* Nat. Trade Press, 1957.
Griffin, T. F. *Practical Worsted Combing.* Nat. Trade Press, 1957.
Morton, W. E. *Introduction to the Study of Spinning.* Textile Book Service, 1949.
Nissan, A. H. *Textile Engineering Processes.* Butterworths, 1959.
Radcliffe, J. W. *Woollen and Worsted Yarn Manufacture.* Emmott, 1953.
Wray, G. R. *Modern Yarn Production from Man-made Fibres.* Textile Book Services, 1968.
Manual of Cotton Spinning. Vol. II, Part 2. *Opening and Cleaning.* Butterworths, London & Textile Inst., Manchester, 1963.
Manual of Cotton Spinning. Vol. IV, Part I. *The Principle of Roller Drafting.* Vol. IV, Part II. *Drawframes, Combers and Speedframes.* Butterworths, London & Textile Inst., Manchester, 1964.
Manual of Cotton Spinning. Vol. III. *Carding.* Vol. V. *The Principles and Theory of Ring Spinning.* Butterworths, London & Textile Inst., Manchester, 1965.
Studies in Modern Yarn Production. Papers of the Textile Inst. Annual Conf. Textile Inst., Manchester, 1968.
von Bergen, W. *Wool Handbook.* Vol. 2. 3rd ed. Interscience, 1970.
Wool Research. Vol. IV. *Carding.* Vol. VI. *Drawing and Spinning.* WIRA, Leeds, 1948.

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 infrared absorption. Molecular and morphological structure of fibres, crystallinity and orientation of polymers. First and second order phase transi-

tions. Relationship between molecular structure and mechanical properties of fibres.

TEXTBOOK

Peters, R. H. *Textile Chemistry*. Vol. 1. Elsevier, 1963.

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, idealised helical yarn geometry, fibre migration, mechanics of twisted continuous filament 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., and Backer, S. *Structural Mechanics of Fibres, Yarns and Fabrics*. Vol. 1. Intersci., 1969.

13.213 Textile Science III

Mechanical properties and rheological behaviour of fibres and fibre assemblies including a thermodynamic and kinetic treatment of fibre deformation. Physical properties of textile materials including water adsorption, electrical properties, heat and moisture transfer. Geometry of yarn and fabric structures. Aspects of colour, colour mixing and colour vision. Introduction to adsorptiometry, spectrophotometry and tristimulus colorimetry. Measurement and specification of colour. Applications of colour measurement in textile dyeing.

TEXTBOOK

Wright, W. D. *The Measurement of Colour*. 4th ed. Adam Hilger, 1969.

PRINCIPAL REFERENCE BOOKS FOR TEXTILE SCIENCE I, II and III

Alexander, P., Hudson, R. F. & Earland, C. *Wool: Its Chemistry and Physics*. 2nd ed. Chapman & Hall, 1963.
Alfrey, T. *Mechanical Behaviour of High Polymers*. Wiley, 1948.
Astbury, W. T. *Fundamentals of Fibre Structure*. O.U.P., 1933.
Astbury, W. T. *Textile Fibres under the X-rays*. I.C.I.
Barrow, G. M. *The Structure of Molecules*. Benjamin, 1964.
Billmeyer, F. W. *Textbook of Polymer Science*. 2nd ed. Wiley, 1971.
Bikales, N. M. & Segal, L. *Cellulose and Cellulose Derivatives. High Polymers*. Vol. 5. Parts IV & V. Wiley-Interscience, 1971.
Borasky, R. *Ultrastructure of Protein Fibres*. Academic, 1963.
Bowden, F. P. & Tabor, D. *Friction and Lubrication*. Methuen, 1956.
Eirich, F. R. *Rheology*. Vols I and II. Academic, 1956.
Ferry, J. D. *Viscoelastic Properties of Polymers*. Wiley, 1961.
Flory, P. J. *Principles of Polymer Chemistry*. Cornell U.P., 1953.
Fraser, R. D. B., McRae, T. P. & Rogers, G. E. *Keratins. Their Composition, Structure and Biosynthesis*. Thomas, 1972.
Frey-Wyssling, A. *Submicroscopic Morphology of Protoplasm and Its Derivatives*. Elsevier, 1948.
Glasstone, S., Laidler, K. J. & Eyring, H. *The Theory of Rate Processes*. McGraw-Hill, 1941.
Hearle, J. W. S. & Peters, R. H. eds. *Fibre Structure*. Butterworth, London & Textile Inst., Manchester, 1963.

Hearle, J. W. S. & Peters, R. H. *Moisture in Textiles.* Butterworth, London & Textile Inst., Manchester, 1960.
Hermans, P. H. *Physics and Chemistry of Cellulose Fibres.* Elsevier, 1949.
Heyn, A. N. J. *Fibre Microscopy.* Wiley, 1954.
Hill, R. ed. *Fibres from Synthetic Polymers.* Elsevier, 1953.
Howell, H., Mieszkis, K. W. & Tabor, D. *Friction in Textiles.* Butterworths, 1959.
Judd, D. B. & Wyszecki, G. *Colour in Business, Science and Industry.* 2nd ed. Wiley, 1963.
Kaswell, E. R. *Textile Fibres, Yarns and Fabrics.* Reinhold, 1953.
Meredith, R. *Mechanical Properties of Textile Fibres.* North-Holland, 1956.
Meredith, R. & Hearle, J. W. S. eds. *Physical Methods of Investigating Textiles.* Wiley, 1959.
Moore, W. R. *An Introduction to Polymer Chemistry.* London U.P., 1963.
Morton, W. E. & Hearle, J. W. S. eds. *Physical Properties of Textile Fibres.* Butterworth, London and Textile Inst., Manchester, 1962.
Optical Society of America. *The Science of Colour.* Crowell, N.Y., 1953.
Oster, G. & Pollister, A. W. *Physical Techniques in Biological Research.* Vols I and II. Academic, 1955.
Ott, E. & Spurlin, H. M. *Cellulose. High Polymers.* Vol. V. Wiley, N. Carolina U.P., 1954.
Preston, J. M. ed. *Fibre Science.* Textile Inst., Manchester, 1953.
Stoves, J. L. *Fibre Microscopy.* Nat. Trade Press, 1957.
Tanford, C. *Physical Chemistry of Macromolecules.* Wiley, 1961.
Textile Institute & Soc. of Dyers & Colourists. *Review of Textile Progress.* Annual.
Tobolsky, A. V. *Properties and Structure of Polymers.* 2nd ed. Wiley, 1962.
Treloar, L. R. G. *The Physics of Rubber Elasticity.* 2nd ed. O.U.P., 1958.
Urquhart, A. R. & Howitt, F. O. *The Structure of Textile Fibres: an Introductory Study.* Textile Inst., Manchester, 1953.
Ward, K. Jnr. *Chemistry and Chemical Technology of Cotton.* Wiley, 1955.
Woods, H. J. *Physics of Fibres.* Inst. of Physics, London, 1955.
Wool Research. Vol. 2. *Physical Properties of Wool Fibres and Fabrics.* WIRA, Leeds, 1955.

Raw Materials

Carrol-Porczynski, C. Z. *Manual of Man-made Fibres.* Astex, Guildford, 1960.
Cook, J. G. *Handbook of Textile Fibres.* 3rd ed. Merrow, Watford, 1964.
Harris, M. *Handbook of Textile Fibres.* Harris Research Lab., Washington, D.C., 1954.
Lord, E. *Manual of Cotton Spinning.* Vol. II. *Cotton Raw Material.* Textile Inst., Manchester, 1961.
McFarlane, S. B. ed. *Technology of Synthetic Fibres.* Fairchild, 1953.
Matthews, J. M. *Textile Fibres.* Wiley, 1947.
Moncrieff, R. W. *Man-made Fibres.* 5th ed. Nat. Trade Press, 1970.
Onions, W. J. *Wool—An Introduction to its Properties, Varieties, Uses and Production.* Benn, 1962.
Press, J. ed. *The Man-made Textile Encyclopaedia.* Wiley, 1959.
Von Bergen, W. *Wool Handbook.* Vols 1 and 2. 3rd ed. Wiley, N.Y., 1963.
Wormell, R. L. *New Fibres from Proteins.* Butterworths, 1954.
American Cotton Handbook. 2 Vols. 3rd ed. Wiley, 1965.

13.223 Advanced Textile Chemistry

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

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

Textile mill location, layout and design. 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.

PRINCIPAL REFERENCE BOOKS FOR TEXTILE ENGINEERING I and II

Clifford, A. E. *Textile Organisation and Production.* Carter, Belfast, 1951.
Cook, A. L. & Carr, C. C. *Elements of Electrical Engineering.* Wiley, 1949.
Eckman, D. P. *Industrial Instrumentation.* Wiley, 1950.
Enrich, N. L. *Industrial Engineering Manual for Textile Industry.* Textile Book Pub., N.Y., 1962.
Greenhut, M. L. *Plant Location in Theory and Practice.* N. Carolina U.P., Chapel Hill, 1956.
Grosberg, P. *An Introduction to Textile Mechanisms.* Benn, 1968.
The Efficient Use of Fuel. H.M.S.O., London, 1958.
Illumination Engineering Soc. Lighting Handbook. Illumination Engin. Soc., N.Y., 1959.
Kent's Mechanical Engineers Handbook. Vol. I. *Power.* Wiley, 1964.
Kent's Mechanical Engineers Handbook. Design and Production. Wiley, 1964.
Kern, D. Q. *Process Heat Transfer.* McGraw-Hill, 1950.
Lyle, O. *The Efficient Use of Steam.* H.M.S.O., 1960.
Michell, A. G. M. *Lubrication: Its Principles and Practice.* Blackie, 1950.
Staniar, W. ed. *Plant Engineering Handbook.* 2nd ed. McGraw-Hill, 1959.
Swale, W. E. *Electricity in Textile Industry.* Nat. Trade Press, 1956.
Wrangham, D. A. *The Theory and Practice of Heat Engines.* 2nd ed. C.U.P., 1948.
Young, A. F. *An Introduction to Process Control System Design.* Longmans, 1957.

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 ACCOUNTANCY

14.081 Introduction to Business Finance

The course objective is 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, 1972.

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, 1975.

Colditz, B. T. & Gibbins, R. W. eds. *Accounting Perspectives.* McGraw-Hill. 1972.

Haskell, D. J., Howitt, G., Kingston, N. & Williams, J. F. *Exercises and Solutions in Accounting and Financial Management.* U.N.S.W., 1975.

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, plus

Grouse, P. J. *An Introduction to Computer Programming in PL/1, Part One: The Simple Subset.* 2nd ed. New College Publications, 1972.

14.602 Information Systems

Management information systems, including data collection and processing, internal control and internal reporting. System design and computer applications.

TEXTBOOKS

Clifton, H. D. *Systems Analysis of Business Data Processing.* 2nd ed. Business Books, 1972.

Grouse, P. J. *An Introduction to Computer Programming in PL/1. Part 1. The Simple Subset.* 2nd ed. New College Publications, 1972.

Mockler, R. J. *Information Systems for Management.* Prentice-Hall, 1974.

SCHOOL OF ECONOMICS

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 monopolistic market structures, an introduction to distribution theory and resource allocation problems.

INTRODUCTORY READING

*Samuelson, P. A., Hancock, K. & Wallace, R. *Economics: Australian Edition*. McGraw-Hill, 1970.

TEXTBOOKS

*Lipsey, R. G. *An Introduction to Positive Economics*. 3rd ed. Weidenfeld & Nicolson, 1971.

*Stilwell, J. A. & Lipsey, R. G. *Workbook to Accompany an Introduction to Positive Economics*. 2nd ed. Weidenfeld & Nicolson, 1971.

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

Commonwealth of Australia. *Australian National Accounts: National Income and Expenditure 1972-1973*. Commonwealth Bureau of Census & Statistics, Canberra, 1974.

*Rowan, D. C. *Output, Inflation and Growth*. Aust. ed. Macmillan, 1975.

15.002 Economics IIA

Microeconomic theory, including consumer theory, oligopolistic competition, market stability and general equilibrium.

TEXTBOOK

Ferguson, C. E. *Micro-Economic Theory*. 3rd ed. Irwin, 1972.

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, 1972.

Layard, R. ed. *Cost-Benefit Analysis*. Penguin, 1972.

*Mishan, E. J. *Cost-Benefit Analysis*. Allen & Unwin, 1971.

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

* Paperback.

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, 1972.
*Nevile, J. W. *Fiscal Policy in Australia*. Cheshire, 1970.
*Rowan, D. C. *Output, Inflation and Growth*. Aust. ed. Macmillan, 1975.
*Wrightsman, D. *An Introduction to Monetary Theory and Policy*. Free Press, 1974.

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 work force, industry, occupations and technology; work-leisure preferences; types of unemployment and Phillips Curve analysis; wage theory and practice, with reference to market forces, collective bargaining and government regulation; the development of the Australian arbitration system, and wage determinants within and outside the arbitration system; wage differentials; wages and incomes policies.

TEXTBOOKS

Niland, J. R. & Isaac, J. R. *Australian Labour Economics. Readings*. Sun Books, 1974.
Rees, A. *The Economics of Work and Pay*. Harper & Row, 1973.

15.003 Economics IIIA

Macroeconomic theory and policy, building directly on 15.042 Economics IIC, 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, 1972.
*Burton, J. *Wage Inflation*. Macmillan, 1972.
*Gibson, N. E. & Kaufman, G. D. *Monetary Economics. Readings in Current Issues*. McGraw-Hill, 1971.
*Nevile, J. W. *Fiscal Policy in Australia*. Cheshire, 1970.
Nevile, J. W. & Stammer, D. eds. *Inflation and Unemployment*. Pelican, 1971.

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, 1973.
Cohen, B. *Balance of Payments Policy*. Penguin, 1969.
Cooper, R. ed. *International Finance*. Penguin, 1969.
Heller, H. R. *International Trade: Theory and Empirical Evidence*. 2nd ed. Prentice-Hall, 1973.
McColl, G. D. ed. *Overseas Trade and Investment*. Pelican, 1972.

* Paperback.

15.043 Comparative Economic Systems

Analysis of different economic systems and the way in which the basic economic problems are solved; a critical appraisal of the efficiency with which resources are allocated in different economies. The emphasis will be on the study of socialist economies, including the U.S.S.R., China and Yugoslavia. The Japanese economy will be included as an example of indicative planning.

TEXTBOOKS

*Bieda, K. *The Structure and Operation of the Japanese Economy*. Wiley, 1970.
Carson, R. L. *Comparative Economic Systems*. Macmillan, 1973.
*Wilczynski, J. *The Economics of Socialism*. Allen & Unwin, 1972.

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, 1973.
*Spiegelglas, S. & Welsh, C. J. eds. *Economic Developments*. Prentice-Hall, 1970.
Sutcliffe, R. B. *Industry & Underdevelopment*. Addison-Wesley, 1971.

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 U.P., 1963.
Dorfman, R. & N. eds. *Economics of the Environment*. Norton, 1972.

15.093 Public Sector Economics

Determinants of the size and structure of the public sector of the economy, the nature of public goods and their effects on economic welfare. Pricing policies of public utilities, application of cost-benefit analysis and other techniques to resource allocation, income redistribution and other objectives of public policy, analysis of transport, health, education, regional, urban and environmental issues.

TEXTBOOKS

Herber, B. P. *Modern Public Finance: The Study of Public Sector Economics*. Rev. ed. Irwin, 1971.
Layard, R. ed. *Cost-Benefit Analysis*. Penguin, 1972.
Munby, D. ed. *Transport*. Penguin, 1968.
*Schreiber, A. F., Gatons, P. K. & Clemmer, R. B. *Economics of Urban Problems*. Houghton Mifflin, 1971.
Turvey, R. ed. *Public Enterprise*. Penguin, 1968.

* Paperback.

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.* 1968.

TEXTBOOKS

*Hughes, J. *Industrialization and Economic History.* McGraw-Hill, 1970.
*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, 1967.

TEXTBOOKS

*Boehm, E. A. *Twentieth Century Economic Development in Australia.* Longman, 1971.
*Forster, C. ed. *Australian Economic Development in the Twentieth Century.* Allen & Unwin, 1970.
*Playford, J. & Kirsner, D. *Australian Capitalism.* Penguin, 1972.
Schedvin, C. B. *Australia and the Great Depression.* Sydney U.P., 1970.

* Paperback.

FACULTY OF BIOLOGICAL SCIENCES

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, 1967.
Boughey, A. S. *Man and the Environment*. Macmillan, 1971.
Cavalli-Sforza, L. L. *Elements of Human Genetics*. Addison-Wesley, 1973.

PRINCIPAL REFERENCE BOOKS

Bates, M. *Man in Nature*. Prentice-Hall, 1964.
Boughey, A. S. *Readings in Man, the Environment and Human Ecology*. Macmillan, 1973.
Carter, C. O. *Human Heredity*. Penguin, 1962.
Ehrlich, P. R., Ehrlich, A. H. O. & Holdren, J. P. *Human Ecology*. Freeman, 1973.
Greenwood, N. H. & Edwards, J. M. B. *Human Environments and Natural Systems*. Duxbury Press, 1973.
Heiser, G. B. *Seed to Civilisation*. Freeman, 1973.
Mulvaney, D. J. & Golson, G. eds. *Aboriginal Man and Environment in Australia*. A.N.U.P., 1973.
Nix, H. A. ed. *The City as a Life System*. Southwood, 1973.
Scientific American. *Biology and Culture in Modern Perspective*. Freeman, 1972.
Scientific American. *Science Conflict and Society*. Freeman, 1968.
Weiner, J. S. *Man's Natural History*. Weidenfeld & Nicolson, 1971.
Young, J. Z. *An Introduction to the Study of Man*. Clarendon, 1971.

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, 1967.
Roberts, M. B. V. *Biology: Functional Approach.* Nelson, 1971.

PRINCIPAL REFERENCE BOOKS

Coult, D. A. *The Working Plant.* Longman, 1973.
Grenville, H. W. *Biology of the Individual.* Longman, 1971.
Griffin, D. R. & Novick, A. 2nd ed. *Animal Structure and Function.* Holt, Rinehart & Winston, 1970.
Kramer, A. ed. *Topics in the Study of Life.* Harper & Row, 1971.
Ray, P. M. 2nd ed. *The Living Plant.* Holt, Rinehart & Winston, 1972.
Springthorpe, E. G. *An Introduction to Functional Systems in Animals.* Longman, 1973.

DEPARTMENT OF INDUSTRIAL ENGINEERING

18.121 Production Management

Pre-requisites: 10.031, 10.331.

Engineering Economics—The structure of the Australian economy. The theory of the firm, pricing, fluctuations in demand. The economics of 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, interrelationships 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, e.g. mathematical programming, queueing theory, inventory models, simulation.

TEXTBOOKS

Buffa, E. S. *Modern Production Management.* 3rd ed. Wiley, 1969.
Lu, F. P. S. *Economic Decision-making for Engineers and Managers.* Whitcombe & Tombs, 1969.
Moore, P. G. *Basic Operational Research.* Pitman, 1968.

PRINCIPAL REFERENCE BOOKS

Barnes, R. M. *Motion and Time Study.* 6th ed. Wiley, 1968.
Greene, J. H. *Production Control Systems and Decisions.* Irwin, 1968.
Hillier, F. S. & Lieberman, G. J. *Introduction to Operations Research.* Holden-Day, 1968.
Smith, G. W. *Engineering Economy.* Iowa State U.P., 1968.

18.131 Operations Research

The formation and optimization of mathematical models of industrial processes. The development of decision rules. Some techniques of operational research and applications, e.g. mathematical programming, queueing theory, inventory models, simulation.

TEXTBOOK

Moore, P. G. *Basic Operational Research.* Pitman, 1968.

PRINCIPAL REFERENCE BOOK

Hillier, F. S. & Lieberman, G. J. *Introduction to Operations Research.* Holden-Day, 1968.

18.551 Operations Research

Pre-requisites: 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, queueing theory, inventory models, replacement and reliability models, and simulation will be introduced. These techniques will be applied to situations drawn from industrial fields, e.g.,

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, 1971.

PRINCIPAL REFERENCE BOOKS

Gass, S. L. *Linear Programming.* 2nd ed. McGraw-Hill, 1964.
Hanssmann, F. *Operations Research in Production and Inventory Control.* Wiley, 1962.
Hillier, F. S. & Lieberman, G. J. *Introduction to Operations Research.* Holden-Day, 1967.
Houlden, B. T. ed. *Some Techniques of Operational Research.* E.U.P., 1962.
Moder, J. J. & Phillips, C. R. *Project Management with CPM and PERT.* Van Nostrand, 1964.

SCHOOL OF CHEMICAL TECHNOLOGY

22.112 Chemical Process Equipment

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.

PRINCIPAL REFERENCE BOOKS

Badger, W. L. & Banchero, J. T. *Introduction to Chemical Engineering.* McGraw-Hill.

Brown, G. G. *Unit Operations.* Wiley.

Foust, A. S., Wenzel, A., Clump, C. W., Maus, L. & Anderson, L. B. *Principles of Unit Operations.* Wiley.

McCabe, W. L. & Smith, J. C. eds. *Unit Operations of Chemical Engineering.* McGraw-Hill.

22.1130 Industrial Chemistry Processes

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.

TEXTBOOKS

Kent, J. A. *Riegel's Industrial Chemistry.* Reinhold. *or*
Shreve, R. N. *Chemical Process Industries.* McGraw-Hill.

22.1131 Organic Industrial Chemistry Processes

For students doing Polymer Option in Industrial Chemistry.

Cellulose, industrial alcohols, formaldehyde, phenol, urea, phenolic and urea resins, acetic acid, polymers based on ethylene and acetylene and elastomers.

Students are also required to attend a series of factory inspections of some local and country industries and to prepare reports on these inspections.

TEXTBOOK

Kent, J. A. *Riegel's Industrial Chemistry.* Reinhold. *or*
Shreve, R. N. *Chemical Process Industries.* McGraw-Hill.

22.114 Processes

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, applied electrochemistry.

PRINCIPAL REFERENCE BOOKS

Bockris, J. O'M. & Reddy, A. K. N. *Modern Electrochemistry.* Vol. 2. Plenum.

Gerrard, G. A. *Proc. A.I.M.E. Symposia on Extraction of Aluminium.* Vol. 2. Wiley.

Underkofler, L. A. & Hickey, R. J. eds. *Industrial Fermentations.* Tudor.

22.122 Instrumental Analysis

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.

PRINCIPAL REFERENCE BOOKS

Delahay, P. *Instrumental Analysis.* Macmillan.

Reilley, C. N. & Sawyer, D. T. *Experiments for Instrumental Methods.* McGraw-Hill.

22.123 Chemical Thermodynamics and Kinetics

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.

PRINCIPAL REFERENCE BOOKS

Darken, L. S. & Gurry, R. W. *Physical Chemistry of Metals.* McGraw-Hill.

Kirkwood, J. G. & Oppenheim, I. *Chemical Thermodynamics.*

Walas, S. M. *Reaction Kinetics for Chemical Engineers.* McGraw-Hill.

22.124 Applied Kinetics

The defect solid state; solid-state diffusion; solid-state reactions; heterogeneous catalysis and heterogeneous kinetics; continuous stirred tank reactors; semi-batch reactors; tubular reactions; fixed bed catalytic reactors; optimization; scale-up of reactors.

TEXTBOOK

Smith, J. M. *Chemical Engineering Kinetics.* McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Levenspiel, O. *Chemical Reaction Engineering.* Pergamon.

Shewmon, P. G. *Solid State Diffusion.* McGraw-Hill.

22.133 Data Processing

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. Applications of the principles of statistics to chemical problems (z test, t test, F test and X^2 test), analysis of variance, design of experiments, correlation and regression, quality control. Use of graphical methods; fitting empirical equations to experimental data. Preparation of nomograms using constructional determinants.

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, 1972.
*McCracken, D. D. *A Guide to Fortran IV Programming.* 2nd ed. Wiley, 1972.
PDP-11 Basic/PTS User's Manual. Digital Equipment Corporation.

PRINCIPAL REFERENCE BOOKS

Davies, O. L. *Statistical Methods in Research and Production.* Oliver & Boyd.
Karbowiak, A. E. & Huey, R. M. *Information, Computers, Machines and Man.* Int. ed. Wiley.

22.134 Applied Thermodynamics

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.

PRINCIPAL REFERENCE BOOKS

Aston, J. G. & Fritz, J. J. *Thermodynamics and Statistical Thermodynamics.* Wiley.
Janaf. *Thermochemical Tables.* Dow Chemical Co.

22.143 Introductory Instrumentation and Analogue Computation

A course of twelve two-hour periods devoted to lectures, demonstrations and laboratory exercises. Offered as part of 2.911 Applied Chemistry.

Conversion of primary variables into electrical signals, measuring instruments, introduction to analogue computation, theory and application of analogue computer elements, analogue computer programming, solution of differential equations, introduction to process control.

22.144 Instrumentation and Process Control

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.

* 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.

PRINCIPAL REFERENCE BOOKS

Caldwell, W. I., Coon, G. A. & Zoss, L. M. *Frequency Response in Process Control.* McGraw-Hill.

Considine, D. M. *Process Instruments and Control Handbook.* McGraw-Hill.

Del Toro, V. & Parker, S. *Principles of Control Systems Engineering.* McGraw-Hill.

Huskey, H. D. & Korn, G. A. *Computer Handbook.* McGraw-Hill.

Johnson, C. L. *Analog Computer Techniques.* McGraw-Hill.

Johnson, E. F. *Automatic Process Control.* McGraw-Hill.

Shilling, G. D. *Process Dynamics and Control.* Holt, Rinehart.

Smith, G. W. & Wood, R. C. *Principles of Analog Computation.* McGraw-Hill.

22.153 Material and Energy Balances

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

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.

PRINCIPAL REFERENCE BOOK

Buckley, P. S. *Techniques of Process Control.* Wiley.

22.163 Instrumentation and Process Control I

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. 1973.

22.164 Management Science

Application of the principles of the feedback control loop to management in the chemical industry and dealing with production, quality control, work study, production planning, economics and project development.

22.174 Seminars

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

An assignment on the integrated design of process flow diagrams involving specification of basic chemical reactions and physico-chemical parameters, selection of types of equipment required, statement of variables to be measured for the control of raw materials, process conditions and final product, and the preparation of a process model suitable for automatic control.

22.213 Chemical Ceramics

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.

PRINCIPAL REFERENCE BOOKS

American Ceramic Soc. *Phase Diagrams for Ceramists.*

Andrews, A. J. *Porcelain Enamels.* Garrard.

Chesters, J. *Steelplant Refractories.* United States Steel Co.

Findlay, A., Campbell, A. N. & Smith, N. O. *The Phase Rule and its Applications.* Dover.

Green, A. T. & Stewart, O. H. eds. *Ceramics: A Symposium.* Brit. Ceramic Soc.

Kingery, W. D. *Introduction to Ceramics.* Wiley.

Klug, H. P. & Alexander, L. E. *X-Ray Diffraction Procedures.* Wiley.

Norton, F. H. *Refractories.* McGraw-Hill.

Parmelee, C. W. *Ceramic Glazes.* 3rd ed. Cahners Books, 1973.

Ryshkewitch, E. *Oxide Ceramics: Physical Chemistry and Technology.* Academic.

Searle, A. B. & Grimshaw, R. W. *The Chemistry and Physics of Clays and Other Ceramic Materials.* Benn.

22.224 Physical Ceramics

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.

PRINCIPAL REFERENCE BOOKS

Burfoot, J. C. *Ferroelectrics.* Van Nostrand.
Darken, L. S. & Gurry, R. W. *Physical Chemistry of Metals.* McGraw-Hill.
Evans, R. P. *Introduction to Crystal Chemistry.* C.U.P.
Gray, T. J. *The Defect Solid State.* Wiley.
Kingery, W. D. *Ceramic Fabrication Processes.* Wiley.
Jaffe, B., Cook, W. R. & Jaffe, H. *Piezoelectric Ceramics.* Academic.
Kittel, C. *Introduction to Solid State Physics.* Wiley.
McKenzie, J. D. *Modern Aspects of the Vitreous State.* Butterworths.
Sinnott, M. J. *Solid State for Engineers.* Wiley.
Smoluchowski, R. *Phase Transformations in Solids.* Wiley.
Stanworth, J. E. *Physical Properties of Glass.* Clarendon.

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

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.

PRINCIPAL REFERENCE BOOKS

Andrews, A. I. *Porcelain Enamels.* 2nd ed. Garrard.
Clews, F. H. *Heavy Clay Technology.* 2nd ed. Academic.
Ford, W. F. *Institute of Ceramics Textbook Series, IV Effect of Heat on Ceramics.* Maclaren.
Jones, J. T. & Berard, M. F. *Ceramics: Industrial Processing and Testing.* Iowa State U.P.
Lewis, W. K., Radasch, A. H. & Lewis, H. C. *Industrial Stoichiometry.* McGraw-Hill.

Norton, F. H. *Elements of Ceramics.* Addison-Wesley.
Parmelee, C. W. & Harman, C. G. *Ceramic Glazes.* 3rd ed. Cahners Books, 1973.
Salmang, H. & Francis, M. *Ceramics—Physical and Chemical Fundamentals.* Butterworths.
Singer, F. & Singer, S. S. *Industrial Ceramics.* Chapman & Hall.
Wayne, B. E. *Introduction to Technical Ceramics.* Maclaren.

22.2332 Ceramic Engineering I

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

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.

PRINCIPAL REFERENCE BOOKS

AS 1250-1972 *SAA Steel Structures Code.*
Coulson, J. M. & Richardson, J. F. *Chemical Engineering* Vols. 2 and 3. Pergamon.
Dusinberre, G. M. *Heat-Transfer Calculations by Finite Differences.* Int. Textbook Co.
Etherington, H. & Etherington, G. *Modern Furnace Technology.* Charles Griffin.
Keey, R. B. *Drying, Principles and Practice.* Pergamon.
Kern, D. Q. *Process Heat Transfer.* McGraw-Hill.
Kreith, F. *Principles of Heat Transfer.* 2nd ed. Int. Textbook Co.
Magill, P. L., Holden, F. R. & Ackley, C. eds. *Air Pollution Handbook.* McGraw-Hill.
McAdams, W. H. *Heat Transmission.* McGraw-Hill.
Perry, J. H. *Chemical Engineers Handbook.* McGraw-Hill.
Skelland, A. H. P. *Non-Newtonian Flow and Heat Transfer.* Wiley.
Tooley, F. V. *Handbook of Glass Manufacture.* Ogden.
Treybal, R. E. *Mass-Transfer Operations.* 2nd ed. McGraw-Hill.
Trinks, W. & Mawhinney, M. H. *Industrial Furnaces.* Vols 1 and 2. Wiley.
Wilkinson, W. L. *Non-Newtonian Fluids.* Pergamon.

22.313 Polymer Processes

Industrial methods of polymerization: bulk, suspension, emulsion, solution, high pressure. Polymerization processes: stepwise and chain growth, free radical and ionic, Ziegler-Natta catalyst systems. Selected examples taken from polyesters, vinyl and acrylic polymers, phenolic resins, synthetic elastomers. Introduction to qualitative and quantitative analysis by chemical and instrumental methods.

TEXTBOOK

Lenz, R. W. *Organic Chemistry of Synthetic High Polymers.* Wiley.

PRINCIPAL REFERENCE BOOKS

Kappelmeier, C. P. A. ed. *Chemical Analysis of Resin Based Coating Materials*. Wiley.
Long, R. R. & Myers, J. S. *Treatise on Coatings*. Vol. II, Part 1. Dekker.

22.314 Polymer Chemistry

Inorganic polymers, polymers for high temperature service, the use of modern instrumental methods for establishing composition and structure of high polymers.

PRINCIPAL REFERENCE BOOKS

Eaborn, C. *Organo-Silicon Compounds*. Butterworths.
Hawkins, W. L. *Polymer Stabilisation*. Wiley.
Slade, P. E. & Jenkins, L. T. *Thermal Characterization Technique*. Dekker.
Stevens, M. P. *Characterization and Analysis of Polymers of Gas Chromatography*. Dekker.
Henniker, J. C. *Infrared Spectrometry of Industrial Polymers*. Academic.

22.323 Physical Chemistry of Polymers I

Molecular weight applied to macromolecules, number, weight, viscosity and z average molecular weights. Molecular weight distribution. Thermodynamics of polymer solutions related to molecular weight determination. Measurement of molecular weight: viscometry, osmometry, light scattering, ebulliometry, cryoscopy, chemical methods. Fractionation methods.

TEXTBOOK

Billmeyer, F. W. *Textbook of Polymer Science*. Wiley.

PRINCIPAL REFERENCE BOOK

Allen, P. W. ed. *Techniques of Polymer Characterisation*. Butterworths.

22.324 Physical Chemistry of Polymers II

Theory of polymer solutions, polyelectrolytes. Structure/property relationships: Thermal transitions, polymer viscoelasticity.

PRINCIPAL REFERENCE BOOKS

Flory, P. J. *Principles of Polymer Chemistry*. Cornell U.P.
Morawetz, H. *Macromolecules in Solution*. Interscience.
Sharples, A. *Introduction to Polymer Crystallization*. Arnold.

22.333 Polymer Physics I

Stress-strain behaviour of polymeric materials at ordinary and elevated temperatures. Rheological considerations of polymer processing operations. Physical testing of polymers. Design of high polymer formulations.

TEXTBOOK

Schmidt, A. X. & Marlies, C. A. *Principles of High Polymers—Theory and Practice*. McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

A.S.T.M. Standards. Parts 26, 27, 28.
McKelvey, J. M. *Polymer Processing*. Wiley.
Stern, H. J. *Rubber, Natural and Synthetic*. Maclaren.
Treloar, L. R. *The Physics of Rubber Elasticity*. O.U.P.

22.334 Polymer Physics II

Rubber elasticity, extrusion plastometry, rheological aspects of polymer processing operations.

TEXTBOOK

McKelvey, J. M. *Polymer Processing*. Wiley.

PRINCIPAL REFERENCE BOOKS

Eirich, F. R. ed. *Rheology Theory and Application*. Vols I, II and III. Academic.

Flory, P. J. *Principles of Polymer Chemistry*. Cornell U.P.

22.341 Statistical Techniques

The application in the Polymer industry of the z test, t test, chi-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.

CHEMICAL TECHNOLOGY GRADUATE SUBJECTS

22.311G Polymer Processes I

Classification of polymers; methods of polymerization—bulk, suspension, emulsion, high pressure. Processes; stepgrowth, chain growth. The chemistry and applications of polymer systems including—polyesters, vinyl polymers, phenolic condensation resins, synthetic rubbers and elastomers, fluorinated polymers. Natural polymers.

TEXTBOOK

Lenz, R. W. *Organic Chemistry of Synthetic High Polymers*. Wiley.

PRINCIPAL REFERENCE BOOKS

Fettes, E. M. *Chemical Reactions of Polymers*. Wiley.

Kline, G. M. *Analytical Chemistry of Polymers*. Wiley.

Long, J. S. & Myers, R. R. *Treatise on Coatings*. Vol. I, Parts I-III. Dekker.

Long, R. *The Production of Polymer and Plastics Intermediates from Petroleum*. Butterworths.

Schildknecht, C. A. *Vinyl and Related Polymers*. Wiley.

22.312G Polymer Processes II

Polymers containing backbones other than carbon: phosphorus, arsenic, sulphur; polysiloxanes.

Instrumental analytical methods, U.V. and I.R. spectroscopy, endgroup analysis, vapour phase chromatography; degradation; X-rays, radioisotopes; stereoisomers, chemical methods.

PRINCIPAL REFERENCE BOOKS

Eaborn, C. *Organo-Silicon Compounds*. Butterworths.

Hunter, D. N. *Inorganic Polymers*. Wiley.

22.321G Physical Chemistry of Polymers I

Mechanisms and Kinetics: stepgrowth polymerization kinetics, structure effects, chain growth polymerization. (i) Free radical polymerization—chemistry and properties of free radicals and initiators; kinetics, transfer reactions; copolymerization; monomer radical structure and reactivity, (ii) ionic polymerization including stereo-regular polymers.

Polymer Characterization: molecular weight average distributions, thermodynamics of polymer solutions; theta temperature; measurement of number average and weight average molecular weights; ultra centrifuge; optical properties; monomolecular films; thermal methods, fractionation methods and their limitations, dual dispersity; control of molecular weight.

TEXTBOOK

Billmeyer, F. W. *Textbook of Polymer Science.* Wiley.

PRINCIPAL REFERENCE BOOKS

Allen, P. W. ed. *Techniques of Polymer Characterisation.* Butterworths.
Flory, P. J. *Principles of Polymer Chemistry.* Cornell U.P.
Lenz, R. W. *Organic Chemistry of Synthetic High Polymers.* Wiley.

22.322G Physical Chemistry of Polymers II

(i) Configurational effects; conformational effects; elastomers, fibres, plastics; temperature resistant polymers, rigidity, crystallinity, morphology, kinetics, nucleation, melting, effect on properties; polar interactions; chemical reactivity; chemistry of adhesion; stereoregular polymers; tacticity; biological systems; medical application of plastics; choice and design of materials for specific applications. (ii) Degradation—thermal, photolytic, mechanical and ultrasonic radiation, oxidative, model compounds; biological degradation; protection of materials against degradation.

TEXTBOOK

Sharples, A. *Introduction to Polymer Crystallization.* Arnold.

PRINCIPAL REFERENCE BOOKS

Hawkins, W. L. ed. *Polymer Stabilization.* Interscience.
Meares, P. *Polymers: Structure and Bulk Properties.* Nostrand.

22.331G Polymer Engineering I

(*a*) *Polymer Compound Design*—Safety precautions. Formulation principles of: elastomers, thermosets, thermoplastics, adhesives and bonding, cellular polymers (open and closed cell, rigid and flexible), surface coatings, films, sheeting and pipes. Formulation cost data. Milling, mixing and curing of polymer formulations.

(*b*) *Polymer Processing*—Mixing and dispersion; extrusion fundamentals (screw type)—isothermal operation, adiabatic operation, die design; ram extrusion fundamentals; screwless extrusion fundamentals; injection moulding (plastics and elastomers); press and transfer moulding; calendering; sheet forming; hollow articles; sealing and welding.

(*c*) *Laboratory*—Selected experiments illustrating principles developed in lectures.

Natural rubber gum stock; carbon black reinforced tyre tread stock; neoprene compound design; acrylonitrile compound design; flexible PVC compound design; plasticizer ratios in PVC; polyester castings; glass

reinforced—polyester laminates; polyurethane foams; epoxy chemical resistant coatings; surface coating formulation and testing.

Mixing processes (2- and 3-roll mills and Banbury mixer); dispersion processes Sigma arm mixer) press moulding of thermosets; injection moulding of polyethylene and nylon; screw extrusion of thermoplastics (1½" extruder); screw extrusion of elastomers (1½" extruder); screwless extrusion of thermoplastics; vacuum forming from sheet material; hot gas welding of thermoplastics; hot sealing of plastic films.

TEXTBOOKS

McKelvey, J. M. *Polymer Processing.* Wiley.
Schmidt, A. X. & Marlies, C. A. *Principles of High Polymers—Theory and Practice.* McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Materials and Compounding Ingredients for Rubber. Bill Communications Inc. N.Y.
Stern, H. J. *Rubber, Natural and Synthetic.* Maclaren.
Wilson, B. J. *British Compounding Ingredients for Rubber.* W. Hefler, Cambridge.
A.S.T.M. Standards. Parts 14, 20, 21, 24, 25, 26, 27, 28.

22.332G Polymer Engineering II

(*a*) *Polymer Physical Properties and Engineering Applications of Polymers*—

(i) *Polymer Physical Properties*—Theory of rubber elasticity; molecular chain tension; force-extension fundamentals; large strain region in elastomers; rheological phenomena (flow); extrusion plastometry; reinforcement of polymer physical properties.

(ii) *Engineering Applications of Polymers*—Thermosets thermoplastics; elastomers, cellular polymers; adhesives and bonding; surface coatings; thermal and acoustic insulation; vibration isolation; chemical resistance; accelerated ageing.

(*b*) *Physical Testing II*—Density of solid and cellular polymers; hardness, stress-strain fundamentals (ultimate tensile strength, modulus) for thermosets, thermoplastics and elastomers; elastic modulus; work of deformation; compressive strength and modulus; shear; torsion; flexural strength and modulus; impact; resilience; flex cracking; tear. Creep; relaxation; first and second order transition; thermal conductivity through polymers; extrusion plastometry; cone and plate viscometry (solid polymers).

(*c*) *Laboratory*—Stress-strain; creep; relaxation; second order transition; thermal conductivity (K factor); cell size and per cent closed cells (cellular polymers); refractive index; extrusion plastometer; cone and plate viscometer; Mooney viscometer.

TEXTBOOKS

Stern, H. J. *Rubber, Natural and Synthetic.* Maclaren.
Treloar, L. R. *The Physics of Rubber Elasticity.* O.U.P.

PRINCIPAL REFERENCE BOOKS

Burton, W. E. *Engineering with Rubber.* McGraw-Hill.
Eirich, F. R. ed. *Rheology Theory and Application.* Vols I, II & III. Academic.
Flory, P. J. *Principles of Polymer Chemistry.* Cornell U.P.
Houwink, R. *Elastomers and Plastomers.* Vols I & II. Elsevier.
A.S.T.M. Standards. Parts 14, 20, 21, 24, 25, 26, 27, 28.

SCHOOL OF NUCLEAR ENGINEERING

23.051 Nuclear Power Technology

Nuclear processes, fission and energy deposition, nuclear reaction rates, fuel cycles and nuclear reactor types. Primary and secondary radiation sources, multiplication slowing down and diffusion of neutrons, criticality conditions and reactivity changes with burnup. Fine scale flux in fuel element lattices, effects of control rods and reflectors. Delayed neutrons, point reactor neutron kinetics, and reactor control.

Heat conduction, transfer and transport in canned reactor fuel elements and reactor coolant channels. Gas, non-metallic fluid and liquid metal cooling. Boiling, two phase flow and burnout problems. Void, temperature and fission product power reactivity feedback mechanisms. Thermo-mechanical aspects of reactor core performance.

The thermodynamics of nuclear power systems. The special nuclear, thermal and cost characteristics of gas cooled, pressurised water, boiling water and liquid metal fast reactor systems. Isotopic power generators, process heat and other reactor applications.

PRINCIPAL REFERENCE BOOKS

Bonilla, C. F. *Nuclear Engineering.* McGraw-Hill.
El Wakil, M. M. *Nuclear Power Engineering.* McGraw-Hill.
Glasstone, S. & Sesonske, A. *Nuclear Reactor Engineering.* Van Nostrand.
Directory of Nuclear Reactors—Power Reactors. Vol. IV, 1962. Vol. VII, 1968. Vol. IX, 1971. Int. Atomic Energy Agency, Vienna.
International Conference on Nuclear Power Costs. Int. Atomic Energy Agency, Vienna, 1968.
Nuclear Energy Costs and Economic Development. Int. Atomic Energy Agency, Vienna, 1970.

SCHOOL OF APPLIED GEOLOGY

25.001 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—Introduction to 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. Introduction to 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 three field tutorials, attendance at which is compulsory.

TEXTBOOKS

Bickford, M. E. *et al. Geology Today*. CRM Books, California, 1973.
Black, R. M. *Elements of Palaeontology*. C.U.P., 1970.
Rutley, F. *Elements of Mineralogy*. Read, H. H. ed. Murby, 1970.
Tyrrell, G. W. *The Principles of Petrology*. Methuen.

PRINCIPAL REFERENCE BOOKS

Holmes, A. *Principles of Physical Geology*. N.A.P. *or*
Kostov, I. *Mineralogy*. Oliver & Boyd, 1968.
Packham, G. H. ed. *The Geology of New South Wales. Vol. 16, Part 1, J. Geol. Soc. Aust.* Mercury Press, 1969.

25.002 Geology II

Mineralogy: Principles of optical crystallography; the construction and use of a polarizing microscope. Polymorphism; the crystal chemistry, crystallography and geological occurrence of the main groups of rock forming minerals. Description and recognition of common ore and rock forming minerals in both hand specimen and thin section.

Petrology—Igneous Petrology: Occurrence, genesis and classification of the commoner igneous rocks. Crystallization of magma. Binary systems. The reaction series. Introduction to micropetrography.

Metamorphic Petrology—Principles, concepts and theories relating to the occurrence, origin and classification of metamorphic rocks. A.C.F. and A.K.F. diagrams. Metamorphic facies. Practical: megascopic and microscopic examination of selected metamorphic rocks. Field Work: at least one field trip to illustrate the above course.

Petrology—Sedimentary Petrology: The influence of transportation, deposition and diagenesis on the composition, texture and structure of the sedimentary rocks. The classification of detrital sediments. The non-clastic sediments.

Palaeontology: Morphology and systematics of major fossil Invertebrate phyla (Part 1) and their stratigraphic distribution. Practical: examination of representative fossils from each phylum.

Stratigraphy: Classification of sedimentary rocks. Sedimentary processes. Environments of deposition. The facies concept. Stratigraphic principles. Geosynclines and their evolution. Development of a geosyncline and an intracratonic basin. Stratigraphy of selected provinces of Eastern Australia.

Structural Geology: Description of structures, mesoscopic-macroscopic, fractures, joints, faults, folds and their structural elements; foliation, lineation. Introduction to tectonics and plate tectonics. Practical: stereographic projection; analysis of fractures, faults, folds and their structural elements; foliation, lineation, strain analysis and rotation problems. Field Work: at least one compulsory field trip to illustrate the above course.

TEXTBOOKS

Mineralogy

Bloss, F. D. *An Introduction to the Methods of Optical Crystallography.* Holt, Rinehart & Winston, 1967.
Heinrich, E. W. *Microscopic Identification of Minerals.* McGraw-Hill, 1965.

Petrology

Williams, H., Turner, F. J. & Gilbert, C. M. *Petrography.* Freeman, 1954.
Winkler, H. G. F. *Petrogenesis of Metamorphic Rocks.* 2nd ed. Springer, 1967.

Palaeontology

Moore, R. C., Lalicker, C. G. & Fischer, A. G. *Invertebrate Fossils.* McGraw-Hill, 1952.

Stratigraphy

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, 1968.
Dunbar, C. O. & Rodgers, J. *Principles of Stratigraphy.* Wiley, 1957.

Structural Geology

Ragan, D. M. *Structural Geology—An Introduction to Geometrical Techniques.* 2nd ed. Wiley, 1972.
Spencer, E. W. *Introduction to the Structure of the Earth.* McGraw-Hill, 1969.

PRINCIPAL REFERENCE BOOKS

Mineralogy

Deer, W. A., Howie, R. A. & Zussman, J. *An Introduction to the Rock Forming Minerals.* Longman, 1966.
Kostov, I. *Mineralogy.* Oliver & Boyd, 1968.
Mason, B. & Berry, L. G. *Elements of Mineralogy.* 2nd ed. Freeman, 1968.

Petrology

Hyndman, D. W. *Petrology of Igneous and Metamorphic Rocks.* McGraw-Hill, 1972.
Joplin, G. A. *A Petrography of Australian Metamorphic Rocks.* A. & R. 1968.
Turner, F. J. *Metamorphic Petrology.* McGraw-Hill, 1968.

Palaeontology

Beerbower. *Search for the Past.* Prentice-Hall, 1969.
Easton, W. H. *Invertebrate Palaeontology.* Harper, 1960.
Schrock, R. R., & Twenhofel, W. H. *Principles of Invertebrate Palaeontology.* McGraw-Hill.

Stratigraphy

Pettijohn, S. J. *Sedimentary Rocks.* 2nd ed. Harper.

Structural Geology

Hills, E. S. *Elements of Structural Geology.* 2nd ed. Wiley, 1972.
Phillips, F. C. *The Use of Stereographic Projection in Structural Geology.* 3rd ed. Arnold, 1971.
Whitten, E. H. T. *Structural Geology of Folded Rocks.* Wiley, 1966.

25.003 Geology III

Economic Geology I—Principles and theories of ore formation. Magmatic, hydrothermal, submarine exhalative deposits. Sedimentary deposits including biogenetic alluvial and residual deposits. Metallic and non-metallic economic minerals. Hand specimen and elementary mineragraphic practical work.

Geophysics—An introduction to the physics, shape, structure, constitution and dynamics of the earth: seismology, gravity, geodesy, geothermy, geomagnetism, palaeomagnetism. An introduction to main methods of geophysical exploration.

Igneous Petrology—Magma types and differentiation trends. Ternary systems. Effects of load pressure and water vapour pressure on phase equilibria. Micropetrography of a wide range of igneous rocks.

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.

Oceanography—Dynamic properties of the oceanic water-masses. Physics and chemistry of sea water. Submarine geology and cartography. Recent sedimentation and its correlation with terrestrial stratigraphy. Sediments of organic origin. Oceanic materials of economic importance.

Palaeontology—Morphology and systematics of major fossil invertebrate phyla (Part 2) and their stratigraphic distribution. Palaeobotany. Vertebrate Palaeontology: an introduction to the evolution of the vertebrates. Elements of Palaeoecology. Practical: practical applications of Palaeontology and Palaeoecology.

Metamorphic Petrology—Metamorphic mineral assemblages, fabric. Experimental petrology, metamorphic reactions. Facies and facies series. Metamorphic mapping. Metamorphic petrology of Australia. Practical: Megascopic and microscopic examination of classic metamorphic rock

suites. Mineral assemblages and fabric studies. Field Work: At least one field trip to study structural and mineral problems in metamorphic terrain.

Stratigraphy—Advanced stratigraphic principles and techniques. Biostratigraphy and the use of selected fossil groups in stratigraphic correlation. Geochronology. Geosynclines and plate tectonics. Sedimentational and tectonic history of selected provinces in Australia. The theory of continental drift and its stratigraphic implications.

Tectonics—The geophysical, sedimentological, petrological and structural geological aspects of global geotectonics.

TEXTBOOKS

Economic Geology

Park, C. F., and MacDiarmid, R. A. *Ore Deposits.* 2nd ed. Freeman, 1970.
Stanton, R. *Ore Petrology.* McGraw-Hill, 1972.

Geophysics

Howell, B. *Introduction to Geophysics.* McGraw-Hill, 1959.
Parasnis, D. S. *Principles of Applied Geophysics.* Chapman & Hall, 1972.

Igneous Petrology

Deer, W. A., Howie, R. A., and Zussman, J. *Rock Forming Minerals.* Longman, 1966.
Turner, F. J., and Verhoogen, J. *Igneous and Metamorphic Petrology.* McGraw-Hill, 1960.

Metamorphic Petrology

Joplin, G. *A Petrography of Australian Metamorphic Rocks.* A. & R., 1968.
Winkler, H. G. F. *Petrogenesis of Metamorphic Rocks.* 2nd ed. Springer, 1967.

Mineralogy

As for 25.002 Mineralogy plus
Azaroff, L. V., and Donahue, R. J. *Laboratory Experiments in X-ray Crystallography.*
Zussman, J. ed. *Physical Methods in Determinative Mineralogy.* Academic, London, 1967.

Palaeontology

As for 25.002 Palaeontology plus
Ager, D. V. *Principles of Palaeoecology.* McGraw-Hill, 1963.
Colbert, E. H. *Evolution of the Vertebrates.* Wiley.
Von Koenigswald, G. H. R. *The Evolution of Man.* Michigan U.P., 1962.

Stratigraphy

As for Stratigraphy in 25.002 plus
Krumbein, W. C., and Sloss, L. L. *Stratigraphy and Sedimentation.* 2nd ed. Freeman, 1963.

Tectonics

Cox, A. *Plate Tectonics.* Freeman, 1973.
Gaskell, T. F. *Physics of the Earth.* Thames & Hudson, 1970.

PRINCIPAL REFERENCE BOOKS

Geophysics

Bott, M. H. P. *The Interior of the Earth.* Arnold, 1971.
Dobrin, M. B. *Geophysical Prospecting.* McGraw-Hill, 1960.
Parasnis, D. S. *Mining Geophysics.* 2nd ed. Elsevier, 1973.
Stacey, F. D. *Physics of the Earth.* Wiley, 1969.

Vertebrate Palaeontology

Von Koenigswald, G. H. R. *The Evolution of Man.* Michigan U.P., 1962.

Stratigraphy

Berry, W. B. N. *Growth of a Prehistoric Time Scale Based on Organic Evolution.* Freeman, 1968.
Lahee, F. H. *Field Geology.* McGraw-Hill, 1962.

Economic Geology

Lindgren, W. *Mineral Deposits.* 4th ed. McGraw-Hill, 1933.
Bateman, A. M. *Economic Mineral Deposits.* 2nd ed. Wiley, 1950.

Igneous Petrology

Barth, T. W. *Theoretical Petrology.* 2nd ed. Wiley, 1965.

Metamorphic Petrology

Mehnert, K. R. *Migmatites.* Elsevier, 1968.
Miyashiro, A. *Metamorphism and Metamorphic Belts.* Allen & Unwin, 1973.
Spry, A. *Metamorphic Textures.* Pergamon, 1969.
Turner, F. J. *Metamorphic Petrology.* McGraw-Hill, 1968.

Mineralogy

Nuffield, E. W. *X-ray Diffraction Methods.* Wiley, 1966.
Azaroff, L. V. *Elements of X-ray Crystallography.* McGraw-Hill, 1968.

Palaeontology

Arnold. *An Introduction to Palaeobotany.* McGraw-Hill, 1947.
Moore, H. B. *Marine Ecology.* Wiley, 1965.
Imbrie, J. & Newell, N. D. eds. *Approaches to Palaeoecology.* Wiley, 1964.

Tectonics

Bodechtel, D. & Gierloff-Emden, H. G. *The Earth from Space.* Wren, 1974.
Goguel, D. *Tectonics.* Freeman, 1966.
Jacobs, J. A., Russell, R. D. & Tuzo Wilson, J. *Physics and Geology.* 2nd ed. McGraw-Hill, 1974.

25.0041, 25.0042, 25.0043, 25.0044 and 25.0045 Geology IV

The course consists of 25.0041 and 25.0045, and one of 25.0042 or 25.0043 or 25.0044.

25.0041 Advanced Applied Geology

Exploration Geophysics—Application of gravity, magnetic, seismic and electrical methods in exploration for minerals, hydrocarbons and groundwater.

Computer Applications in Geological Analysis—Advanced methods of mathematical geology, including stochastic processes, deterministic simulation, ore body delineation, ore reserve estimation, exploration risk classification and prediction, and introduction to methods of operations research.

Clay Mineralogy—The distribution of clay minerals in modern and Ancient Sediments. Some applied aspects of clay mineralogy. Laboratory work to illustrate the lecture course.

Geochemistry—Sampling, sample preparation; some modern analytical procedures. Factors governing elemental distributions. Examination of some well-documented geochemical investigations.

Seminar—A weekly activity in which all students will participate.

TEXTBOOKS

25.0041

Dobrin, M. B. *Geophysical Prospecting.* McGraw-Hill, 1960.
Jenkins, R. & De Vries, L. *Practical X-ray Spectrometry.* 2nd ed. Philips Tech. Library, Eindhoven.
Koch, G. S. & Link, R. F. *Statistical Analysis of Geological Data.* Vol. 2. Wiley, 1971.
Parasnis, D. S. *Principles of Applied Geophysics.* Chapman & Hall, 1972.

PRINCIPAL REFERENCE BOOKS

25.0041

Grant, F. S. & West, G. F. *Interpretation Theory in Applied Geophysics.* McGraw-Hill, 1965.
Harbaugh, J. W. & Merriam, D. F. *Computer Applications in Stratigraphic Analysis.* Wiley, 1968.
Harbaugh, J. W. & Bonham-Carter, G. *Computer Simulation in Geology.* Wiley, 1970.
Keller, H. B. & Frischkenect, F. C. *Electrical Methods in Geophysical Prospecting.* Pergamon, 1966.
Parasnis, D. S. *Mining Geophysics.* Elsevier, 1966.
Wedepohl, K. H. ed. *Hand Book of Geochemistry.* Springer-Verlag, Berlin, 1969.
Wyllie, M. R. J. *The Fundamentals of Well Log Interpretation.* 3rd ed. Academic, 1963.

25.0042 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: flow; relevant properties of rocks. Hydrogeological mapping and maps. Pollution of groundwater. Arid zone hydrology.

Environmental Geology—Geology in urban development and regional planning. Terrain evaluation and rehabilitation with special reference to beaches.

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.

TEXTBOOKS

Heath, R. C. & Trainor, F. W. *Introduction to Groundwater Hydrology.* Wiley, 1968.
Krynine, D. P. & Judd, W. R. *Principles of Engineering Geology and Geotechnics* McGraw-Hill, 1957.

PRINCIPAL REFERENCE BOOKS

Coates, D. F. *Rock Mechanics Principles. Mines Branch: Department of Energy, Mines and Resources, Canada.* 2nd ed. Queens Printer, Ottawa, 1970.
Paige, S. ed. *The Applications of Geology to Engineering Practice.* Berkey Volume: Geological Society of America. N.Y., 1950. (reprint 1958).
Marshall, T. J. *Relations between Water and Soil.* British C'wlth. Agric. Bureaux, London, 1959.
Stagg, K. G. & Zienkiewicz, O. C. *Rock Mechanics in Engineering Practice.* Wiley, 1968.
Terzaghi, K. & Peck, R. B. *Soil Mechanics in Engineering Practice.* Wiley, 1948 (1960 reprint).

25.0043 Mineral Exploration

Mineral Exploration—Theory and application of exploration techniques, including geochemical prospecting and soil-gas geochemistry; remote sensing and radiometric surveys. Geological appraisal. "Proving" ore discoveries. Cost factors in exploration.

Structural Analysis—Advanced techniques in solving field and applied problems of rock deformation.

Petrogenesis—Advanced studies in the geochemistry of rock-forming minerals and in igneous and metamorphic petrogenesis; advanced petrofabrics.

TEXTBOOKS

Lawrence, L. J. *Exploration and Mining Geology.* A.I.M.M., Melbourne, 1965.
Turner, F. J. *Metamorphic Petrology.* McGraw-Hill, 1968.
Whitten, E. H. T. *Structural Geology of Folded Rocks.* Rand McNally, 1966.

PRINCIPAL REFERENCE BOOKS

Forrester, J. D. *Field and Mining Geology.* Wiley, 1946.
Glover, J. J. E. ed. *The Archaean.* Spec. Pub. No. 3. Geol. Soc. Aust., 1971.
McKinstry, H. E. *Mining Geology.* Prentice-Hall, New York, 1949.
Ramsay, J. G. *Folding and Fracturing of Rocks.* McGraw-Hill, 1967.
Turner, F. J. & Weiss, L. E. *Structural Analysis of Metamorphic Tectonites.* McGraw-Hill, 1963.
Weiss, L. E. *The Minor Structures of Deformed Rocks.* Springer-Verlag, 1972.
Wilson, H. D. B. ed. *Magmatic Ore Deposits.* Soc. Econ. Geol. Monograph 4, 1969.

25.0044 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, 1967.
Loeblich, A. R. & Tappan, H. *The Treatise on Invertebrate Palaeontology —Part C. Protista.* 1964 Geol. Soc. America, 1964.

PRINCIPAL REFERENCE BOOKS

Carter, A. N. *Tertiary Foraminifera from Gippsland and their Stratigraphical Significance.* Geol. Surv. Vic., 1964.
Haun, J. D. & Leroy, L. W. eds. *Subsurface Geology in Petroleum Exploration.* Colorado School of Mines, 1958.
Weeks, L. G. *Habitat of Oil.* Amer. Assoc. Petroleum Geologists, 1958.
Wopfner, H. & Douglas, J. G. *The Otway Basin of Southeastern Australia.* Geol. Surv., Vic. & S.A., 1971.

25.0045 Project

25.023 Geology III (Applied)

Clay Mineralogy—The structures and properties of the clay minerals. Techniques for their identification. Clay-water systems and ion exchange. Chemical weathering and the origin of clay minerals.

Economic Geology II—Case histories; discovery, exploration, exploitation. Procedures in marking and lodging claims, leases, various types of mining titles, obligations under mining Acts.

Fuels—Origin and distribution of coals. The type, rank and grade of coal. Coal petrography. Structural and stratigraphical occurrence of oil. Reservoir mechanics and reservoir assessment.

Geochemistry—Some modern methods of rock and mineral analysis. Accuracy, precision and quality of geochemical data. The distribution of elements in terrestrial rocks. Norms.

Geological Surveying (and Photogeology)—Part I offered by the School of Surveying: (see subject 29.441 Part A only) Part II contour surveying and structure contour techniques. Mining surveying. Hydrographic surveying. Basic principles of cartography. Theoretical elements of Photogrammetry, aerial photographs and maps. Photomosaics. Principles of photointerpretation.

Mathematical Geology—Measurement scales and models, probability axioms, frequency distributions basic parametric and non parametric statistics, introduction to geostatistics and lognormal assay distributions, sampling procedures line and surface fitting and the analysis of mappable geological variates. Fortran programming exercises form an important part of this course.

Oceanography—Dynamic properties of the oceanic water-masses. Physics and chemistry of sea water. Submarine geology and cartography. Recent sedimentation and its correlation with terrestrial stratigraphy. Sediments of organic origin. Oceanic materials of economic importance.

Micropalaeontology—The morphology, taxonomy and stratigraphic distribution of the principal groups of microfossils. Practical: study and description of foraminifera, ostracoda, conodonts and plant microfossils, also certain examples of megafossils from the invertebrate phyla. Micropalaeontological techniques.

Mineragraphy—Reflected light optics—orthoscopic and conoscopic, measurement of optical parameters in reflected light, microhardness and reflectivity-photometric and photoelectric measurements. Methods of ore mineral identification in reflected light. Microparagenesis and ore textures. Phase equilibrium studies. *Laboratory*—Mineragraphic preparations, polishing methods. Measurement of optical properties. Mineralogical and textural features of selected suites of ore minerals.

Sedimentary Petrology—The chemistry of weathering and soil formation. 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. Stratigraphic maps and stratigraphic photo-interpretation. Field tutorial project.

Field Work—will be held during the year. This includes a geological survey camp which will be held in the first session and ten days of field instruction. Attendance is compulsory.

TEXTBOOKS

Clay Mineralogy

Loughnan, F. C. *Chemical Weathering of Silicate Minerals.* American Elsevier.

Fuels

Levorsen, A. I. *Petroleum Geology.* Freeman, 1954.
Raistrick, H. & Marshall, C. E. *The Nature and Origin of Coal and Coal Seams.* E.U.P., 1952.

Geochemistry

Ahrens, L. H. *Distribution of the Elements in our Planet.* McGraw-Hill.
Zussman, J. ed. *Physical Methods in Determinative Mineralogy.* Academic, 1967.

Geological Surveying and Photogeology

Leuder, D. R. *Aerial Photographic Interpretation.* McGraw-Hill, 1959.

Mathematical Geology

Davis, J. C. *Statistics and Data Analysis in Geology.* Wiley.

Micropalaeontology

Glaessner, M. F. *Principles of Micropalaeontology.* M.U.P., 1955. Hafner reprinted 1963.

Mineragraphy

Edwards, A. B. *Textures of the Ore Minerals.* 2nd ed. A.I.M.M., 1954.
Pickard, G. L. *Descriptive Physical Oceanography.*

Sedimentary Petrology

Milner, H. B. *Sedimentary Petrography.* 4th ed. Arnold.

Sedimentology

Folk, R. L. *Petrology of Sedimentary Rocks.* Texas U.P., 1968.

PRINCIPAL REFERENCE BOOKS

Geochemistry

Wedepohl, K. H. *Handbook of Geochemistry*. Springer, 1969.

Mathematical Geology

Blatt, J. M. *Introduction to Fortran IV Programming*. Goodyear.
Koch, G. S. & Link, R. F. *Statistical Analysis of Geological Data*. Vols. I & II. Wiley, 1970.
Krumbein, W. C. & Graybill, F. A. *An Introduction to Statistical Models in Geology*. McGraw-Hill, 1965.
Harbaugh, J. W. & Merriam, D. F. *Computer Applications in Stratigraphic Analysis*. Wiley, 1968.

Mineragraphy

Hallimond, A. F. *Manual of the Polarizing Microscope*. Cooke, 1953.
Ramdohr, P. *Ore Minerals and their Textures*. Pergamon, 1969.
Uytenbogaardt, W. *Tables for Microscopic Identification of Ore Minerals*. Princeton U.P.

Sedimentology

Griffiths, J. C. *Scientific Methods in Analysis of Sediments*. McGraw-Hill, 1967.
Menard, H. W. *Marine Geology of the Pacific*.
Shepard, F. P. *Submarine Geology*. 2nd ed. Harper, 1968.

Geochemistry

Fyfe, W. S. *Geochemistry of Solids*. McGraw-Hill, 1964.

25.0303 Geology for Geomorphologists and Pedologists

Pre-requisites: 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, 1968.
Loughnan, F. C. *Chemical Weathering of Silicate Minerals*. American Elsevier.
Milner, H. B. *Sedimentary Petrography*. 4th ed. Arnold.

25.101 Geology for Engineers I

Introduction to physical mineralogy. Silicate crystal structures. The rock forming minerals. Ore minerals. Clay minerals. Igneous activity, sedimentation and metamorphism. The texture and composition of igneous, sedimentary and metamorphic rocks. Weathering of rocks.

Structural geology—stratification, foliations. Folds, faults, joints. Introduction to structural analysis.

Introduction to geomorphology. Geomorphic mapping. Fluviatile and coastal geomorphology.

Laboratory work will consist of exercises related to the lecture course. Two field tutorials will be held at which attendance is compulsory. Satisfactory reports must be submitted.

TEXTBOOK

Blyth, F. G. *Geology for Engineers.* 4th ed. 1960.

25.102 Geology for Engineers II

Mineralogy and Petrology—Crystalline state, crystal symmetry, crystal systems, physical and chemical properties of minerals, crystal optics, micropetrology. Occurrence and structures of igneous rocks, consolidation of magmas, igneous rock classification. Thermal and regional metamorphism. Composition and classification of sedimentary rocks, sedimentation and sedimentary environments, micropetrology. *Laboratory:* Hand specimen crystallography, mineralogy and petrology; thin section petrology.

Stratigraphy and Palaeontology—Principles and methods in stratigraphy; stratigraphy of selected geological provinces of Australia. Systematic Palaeontology—plants and invertebrates, stratigraphic palaeontology. Elementary structural geology. *Laboratory:* study of more common plant and animal fossils. Stratigraphic mapping.

Geophysics—An introduction to the basic principles of geophysics, and to the principles, methods and applications of geophysical exploration, viz. gravity, magnetic, electrical, seismic, radioactive and miscellaneous. Discussion of various physical properties of rocks.

Ore Deposits and Fuels—Nature and origin of ore deposits, ore magmas —synmagmatic, epimagmatic and post-magmatic processes. Submarine exhalative deposits. Sedimentary biogenetic deposits. Alluvial and residual deposits. Nonmetallic ores. Nature and origin of petroleum and coal. Coal seams, type and rank variation, coal petrology, coalfield geology. *Laboratory:* macroscopic study of ores and country rocks, ores in thin and polished sections.

Exploration and Mining Geology—As for 25.0043, Part III, Exploration and Mining Geology.

TEXTBOOKS

Rutley, F. *Rutley's Elements of Mineralogy.* Rev. Read, H. H. Murby, London.

Tyrrell, G. W. *Principles of Petrology: An Introduction to the Science of Rocks.* Methuen, London.

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 corequisite: 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, 1972.

25.151 Geoscience IA

This course is provided for students who do not intend studying geology beyond first year. The first part, during Session 1 is identical to the first part of 25.111 Geoscience, but during Session 2 certain additional topics are presented, while others are treated in less depth than in 25.111 Geoscience. No further units in Geoscience are available after this course.

Physical Geology: The origins, structure and main surface features of the earth. Geological cycle—processes of erosion, transportation, sedimentation and lithification. Surface and subsurface water. Weathering, lakes, rivers, glacial phenomena, geomorphology under different climatic regimes. Vulcanism, earthquakes, orogenesis and epeirogenesis. Outlines of plate tectonic theory in relation to continental drift and oceanography.

Crystallography and Mineralogy: Introduction to crystal symmetry, systems, forms, habit, twinning. Occurrence, form and physical properties of minerals. Basic structures of silicate minerals. Mineral classification. Descriptive mineralogy. Principal rock forming minerals.

Petrology: Field occurrence, lithological characteristics and structural relationships of igneous, sedimentary and metamorphic rocks. Introduction to 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. Identification and description of common minerals and rocks in hand specimen. Recognition and descrip-

tion of examples of important fossil groups. Supplemented by two half day and two full day field tutorials, attendance at all of which is compulsory.

TEXTBOOKS

Bickford, M. E. et al. *Geology Today*. CRM Books, 1973.
Rutley, F. *Rutley's Elements of Mineralogy*. Rev. Read, H. H. Murby.
Tyrrell, G. W. *The Principles of Petrology*. Methuen.

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, parageneses, textures and intergrowths. Elements of fuel geology, construction and refractory materials. *Laboratory: Crystallography*—Examination of crystals and crystal models for symmetry. Stereographic projection of crystals. *Optical Mineralogy*—Examination of minerals and rocks in transmitted and incident light using the polarizing microscope. Determination of refractive indices of crystal fragments by the immersion method. *Descriptive and Determinative Mineralogy*—Macroscopic examination of common minerals with emphasis on economic minerals. Study of texture and intergrowths of common mineral parageneses including the principal rock types in which they occur.

TEXTBOOKS

Hurlbut, C. S. ed. *Dana's Manual of Mineralogy*. Wiley.
Rutley, F. *Rutley's Elements of Mineralogy*. Rev. by H. H. Read, Murby.

APPLIED GEOLOGY GRADUATE SUBJECTS

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, 1972.

PRINCIPAL REFERENCE BOOKS

References to recently published original papers will be given during the course.

25.331G Applied Geophysics 1

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, 1965.

Keller, G. V. & Frischknecht, F. C. *Electrical Methods in Geophysical Prospecting.* Pergamon, 1966.

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, 1965.

Keller, G. V. & Frischknecht, F. C. *Electrical Methods in Geophysical Prospecting.* Pergamon, 1966.

25.335G Applied Geophysics Project Assignment

A project involving interpretation of geophysical field data which may be collected by the student.

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, 1966.

25.404G Environmental Geology

Advanced terrain evaluation. Civil engineering works, extractive and mining industries and the environment. Reclamation and rehabilitation after extraction. Urban development, regional planning and geological environment. Sub-surface disposal of wastes. Groundwater pollution, chemical and biological. Rivers, harbours and beaches.

Laboratory work will include advanced studies in terrain evaluation and the studies of case histories. A field tutorial is included in the course.

PRINCIPAL REFERENCE BOOKS

Bell, G. et al. *Geology of the Melbourne District. Geol. Surv. Vic.* Bull. No. 59. 1967.
Detwyler, T. R. *Man's Impact on Environment.* McGraw-Hill.
Grant, K. *Terrain Classification for Engineering Purposes of the Melbourne Area, Victoria.* C.S.I.R.O. Div. App. Geomechanics Paper No. 11, 1972.
Griffin, R. J. *The Botany Basin. Geol. Surv. N.S.W.* Bull. No. 18.

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, New York.

PRINCIPAL REFERENCE BOOK

Cummings, A. E. *Lectures on Foundation Engineering.* Univ. of Illinois Bull. No. 35.

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, etc., and their inter-relationships. Elements of structural geology, stratification, lenticularity, folding, faulting, unconformities etc.; 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, e.g. Rocky Mountain Arsenal Well etc.

SCHOOL OF GEOGRAPHY

27.001 Applied Physical Geography

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 Press.
*Miller, A. *Meteorology*. Merrill.
*Twidale, C. R. *Geomorphology*. Nelson.
*Whittaker, R. H. *Communities and Ecosystems*. Macmillan.

PRINCIPAL REFERENCE BOOKS

Barry, R. G. & Chorley, R. J. *Atmosphere, Water and Climate*. Methuen.
*Billings, W. D. *Plants, Man and the Ecosystem*. 2nd ed. Wadsworth.
Chorley, R. J. ed. *Water, Earth and Man*. Methuen.
Commonwealth Bureau of Meteorology. *Manual of Meteorology*. Govt. Printer.
CSIRO. *The Australian Environment*. M.U.P.
Daubenmire, R. F. *Plants and Environment*. Wiley.
Daubenmire, R. F. *Plant Communities*. Harper & Rowe.
Odum, E. P. *Ecology*. Holt, Rinehart & Winston.
Riley, D., and Young, A. *World Vegetation*. C.U.P.
Stace, H. C. T. *A Handbook of Australian Soils*. Rellim.
*Strahler, A. N. *An Introduction to Physical Geography*. Wiley.
Thornbury, W. D. *Principles of Geomorphology*. Wiley.

27.002 Applied Economic Geography II

For syllabus and texts see 27.011 Economic Geography.

27.011 Economic Geography

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.

* Paperback.

TEXTBOOK

Hurst, M. E. *A Geography of Economic Behaviour.* Duxbury.

PRINCIPAL REFERENCE BOOKS

Abler, R., Adams, J. S. & Gould, P. *Spatial Organisation.* Prentice-Hall.

Cox, K. R. *Man, Location and Behavior: An Introduction to Human Geography.* Wiley.

Demko, G. J., Schnell, G. A. & Rose, H. M. *Population Geography: A Reader.* McGraw-Hill.

*Ehrlich, P. R. & A. H. *Population, Resources, Environment.* Freeman.

English, P. W. & Mayfield, R. C. *Man, Space, Environment.* O.U.P.

*Haggett, P. *Geography: A Modern Synthesis.* Harper Internat.

*Lloyd, P. E. & Dicken, S. *Location in Space: A Theoretical Approach to Economic Geography.* Harper International.

Logan, M. I. & Missen, G. J. *New Viewpoints in Urban and Industrial Geography.* Reed Education.

McCarty, H. H., & Lindberg, J. B. *A Preface to Economic Geography.* Prentice-Hall.

*Morgan, W. B. & Munton, R. J. C. *Agricultural Geography.* Methuen.

Morrill, R. L. *The Spatial Organisation of Society.* Wadsworth.

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; patterns and dynamics of urban population distributions; urban land use models; the structure of the commercial complex; the location of industry in urban areas; the socio-economic structure of urban populations. Laboratory classes deal with statistical methods in economic geography.

PRINCIPAL REFERENCE BOOKS

Berry, B. & Horton, F. E. *Geographic Perspectives on Urban Systems.* Prentice-Hall.

Breese, G. *Urbanization in Newly Developing Countries.* Prentice-Hall.

Goodall, B. *The Economics of Urban Areas.* Pergamon.

Haggett, P., & Chorley, R. eds. *Socio-economic Models in Geography.* Methuen.

Johnston, R. J. *Urban Residential Patterns.* Bell.

Kelars, J. F. & Nystuen, J. D. *Geography.* McGraw-Hill.

Logan, M. I. & Missen, G. T. *New Viewpoints in Urban and Industrial Geography.* Reed Education.

Perlott, H. S. & Wingo, L. *Issues in Urban Economics.* Johns Hopkins.

Richardson, H. W. *Urban Economics.* Penguin.

Thompson, W. *Issues and Urban Economics.* Johns Hopkins.

Yeates, M. & Garner, B. *The North American City.* Harper & Row.

27.013 Geographic Methods

Students projects based on instruction in research design, data sources, field methods; collection, classification and analysis of data. Includes an emphasis on multivariate techniques and computer library programmes.

* Paperback.

PRINCIPAL REFERENCE BOOKS

*Clawson, M. *Land Use Information.* Johns Hopkins U.P.

Cole, J. P. & King, C. A. M. *Quantitative Geography.* Wiley.

*Dixon, W. J. & Massey, F. J. *Introduction to Statistical Analysis.* McGraw-Hill.

*Jackson, J. N. *Surveys for Town and Country Planning.* Hutchinson.

Kerlinger, R. *Foundations of Behavioural Research.* Holt, Rinehart & Winston.

King, L. J. *Statistical Analysis in Geography.* Prentice-Hall.

Lueder, D. R. *Aerial Photographic Interpretation.* McGraw-Hill.

Siegel, S. *Nonparametric Statistics for the Behavioural Sciences.* McGraw-Hill.

Veldman, D. J. *Fortran Programming for Behavioural Sciences.* Holt, Rinehart & Winston.

Ya-lun Chou. *Statistical Analysis with Business and Economic Applications.* Holt, Rinehart & Winston.

Yeates, M. H. *Introduction to Quantitative Analysis in Economic Geography.* McGraw-Hill.

27.023 Population Geography†

The study of 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.* O.U.P.

PRINCIPAL REFERENCE BOOKS

Borrie, W. D. *The Growth and Control of World Population.* Widenfeld & Nicolson.

Burnley, I. H. ed. *Urbanization in Australia, The Post-War Experience.* C.U.P.

Clarke, J. *Population Geography.* Pergamon.

Cox, P. R. *Demography.* C.U.P.

Pollard, A. H., Farhat Yusuf & Pollard, G. N. *Demographic Techniques.* Pergamon.

Price, C. A. *Southern Europeans in Australia.* O.U.P.

Trewartha, G. *The Less Developed Realm, A Geography of its Population.* Wiley.

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* Paperback.

† Not offered in 1975.

27.103 Climatology

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 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 U.P.

PRINCIPAL REFERENCE BOOKS

Bach, W. *Atmospheric Pollution*. McGraw-Hill.
Chang, Jen-Hu. *Climate and Agriculture*. Aldine.
Chorley, R. J. ed. *Water, Earth and Man*. Methuen.
Chow, Ven Te. ed. *Handbook of Applied Hydrology*. McGraw-Hill.
Gates, D. H. *Energy Exchange in the Biosphere*. Harper & Row.
Landsberg, H. E. ed. *World Survey of Climatology. Vol. 2, General Climatology*. Elsevier.
Mather, J. R. *Climatology: Fundamentals and Applications*. McGraw-Hill.
Platt, R. B. & Griffiths, J. F. *Environmental Measurements and Interpretation*. Reinhold.
Rose, C. W. *Agricultural Physics*. Pergamon.
Slatyer, R. O. & McIlroy, I. C. *Practical Microclimatology*. CSIRO.
World Meteorological Organization. *Guide to Meteorological Instrument and Observing Practices*. W.M.O. Secretariat.
World Meteorological Organization. *Guide to Hydrometeorological Practices*. W.M.O. Secretariat.

27.104 Bioclimatology

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.

PRINCIPAL REFERENCE BOOKS

Bear, F. E. *Soils in Relation to Crop Growth.* Reinholdt, N.Y., 1965.
Black, C. A. *Soil-Plant Relationships.* 2nd ed. Wiley, N.Y., 1968.
Hillel, D. ed. *Optimising the Soil Physical Environment Toward Greater Crop Yields.* Academic, 1972.
Kozlowski, T. T. ed. *Water Deficits and Plant Growth.* Vols. I & II. Academic, 1968.
Lowrey, W. P. *Biometeorology.* Oregon State Univ. Press, 1968.
Lowrey, W. P. *Weather and Life.* Academic, 1970.
Munn, R. E. *Biometeorological Methods.* Academic, 1970.
Pierre, W. H. *et al. Plant Environment and Efficient Water Use.* Amer. Soc. of Agron. & Soil, 1966.
Reifsnyder, W. E. & Lull, L. W. *Radiant Energy in Relation to Forests.* U.S.D.A. Tech. Bull. 1344.
Rose, C. W. *Agricultural Physics.* Pergamon.
Shaw, R. H. *Ground Level Climatology.* Amer. Assoc. Adv. Sci., 1967.
UNESCO. *Agroclimatological Methods. Symp. on Methods in Agroclimatology, 1966.* Univ. of Reading, 1968.
UNESCO. *Plant Response to Climatic Factors. Proc. Uppsala Symp., 1970.* 1973.
Van Wijk, W. R. ed. *Physics of Plant Environment.* North Holland, Amsterdam, 1966.
Waggoner, P. E. *et al. Agricultural Meteorology.* Amer. Meteorol. Soc., 1965.
W.M.O. *Guide to Agricultural Meteorological Practices.* World Meteorological Organisation, 1963.

27.113 Urban Geography*

The city and the urban region as elements of the wider urban system. These elements are viewed from three distinct perspectives; static, connectivity of parts and dynamic process. Topics of particular relevance include temporal modes of explanation, historical development of cities, Asian cities, spatial interaction and diffusion processes within urban networks and spatial decision making in normative and behavioural contexts.

PRINCIPAL REFERENCE BOOKS

Berry, B. J. L., ed. *City Classification Handbook: Methods and Applications.* Wiley.
Bourne, L. S. *Internal Structure of the City: Readings on Space and Environment.* O.U.P.
Brown, L. A. *Diffusion Dynamics.* C. W. K. Gleerup.
Carter, H. *The Study of Urban Geography.* Arnold.
Chapin, F. S. *Urban Land Use Planning.* Univ. of Illinois Press.
Chapin, F. S. & Weiss, S. F. *Urban Dynamics.* Wiley.
Chorley, R. J. & Haggett, P. *Models in Geography.* Methuen.
English, P. W. & Mayfield, R. C. *Man, Space and Environment.* O.U.P.
McConnell, H. & Yaseen, D. W. *Perspectives in Geography I: Models of Spatial Variation.* Northern Illinois U.P.
Meier, R. L. A. *Communication Theory of Urban Growth.* Joint Center for Urban Studies of M.I.T. and Harvard.
Morrill, R. L. *Migration and the Spread and Growth of Urban Settlement.* C. W. K. Gleerup.
Nix, H. A. ed. *The City as a Life System.* Proc. Ecological Society of Australia.

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* Not offered in 1975.

Perloff, H. S. & Wingo, L. *Issues in Urban Economics.* Johns Hopkins Press.
Sweet, D. *Models of Urban Structure.* Aust. & New Zealand Book Co.
Thompson, W. *Preface to Urban Economics.* Johns Hopkins Press.

27.123 Social Geography

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 will include census data handling, questionnaire construction, interviewing, participant observation and other unobtrusive techniques.

PRINCIPAL REFERENCE BOOKS

Burnley, I. H. ed. *Urbanisation in Australia.* C.U.P.
*Cox, K. R. *Conflict, Power and Politics in the City: A Geographic View.* McGraw-Hill.
Davies, A. F. & Encel, S. eds. *Australian Society.* Cheshire.
Frankenberg, R. *Communities in Britain.* Penguin.
Franklin, S. H. *Rural Societies (in Contemporary Europe).* Macmillan.
*Halpern, J. M. *The Changing Village Community.* Prentice-Hall.
*Harries, K. D. *The Geography of Crime and Justice.* McGraw-Hill.
Harvey, D. W. *Social Justice and the City.* Arnold.
Johnston, R. J. *Urban Residential Patterns.* Bell.
Jones, C. E. *Rural Life.* Longman.
Lancaster-Jones, F. *Dimensions of Urban Social Structure.* A.N.U.P.
McGee, T. G. *The South-East Asian City.* Bell.
Mendras, H. *The Vanishing Peasant: Tradition and Change in French Agriculture.* M.I.T. Press.
Mitchell, C. ed. *Social Networks in Urban Situations.* Manchester U.P.
Morrill, R. L. & Wohlenberg, E. H. *The Geography of Poverty in the U.S.A.*
Pahl, R. E. *Patterns of Urban Life.* Longman.

27.124 Geographic Thought and Perspectives

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

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.

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* Paperback.

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 Ecology*. Arnold. 1964.
Odum, E. P. *Fundamentals of Ecology*. 3rd ed. Saunders, 1971.

PRINCIPAL REFERENCE BOOKS

Anderson, R. H. *The Trees of New South Wales*. N.S.W. Govt. Printer.
Barnard, C. *Grasses and Grasslands*. Macmillan, 1964.
Beadle, N. C. W., Evans, O. D. & Carolin, R. L. *Flora of the Sydney District*. Reed.
Curtis, J. T. *The Vegetation of Wisconsin: an Ordination of Plant Communities*. Madison, 1959.
Darlington, P. J. *Biogeography of the Southern End of the World*. Harvard U.P.
Elton, C. S. *The Ecology of Invasions by Animals and Plants*. Methuen, 1958.
Eyre, S. R. *Vegetation and Soils. A World Picture*. 2nd ed. Arnold, 1968.
Eyre, S. R. ed. *World Vegetation Types*. Macmillan, 1971.
Hutchinson, J. *The Families of Flowering Plants*. Vols. I & II. O.U.P.
Keast, A., Crocker, R. L. & Christian, C. S. eds. *Biogeography and Ecology in Australia*. Monographiae Biologicae. Vol. 8. W. Junk.
Lazarides, M. *The Grasses of Central Australia*. A.N.U.P., 1970.
Leper, C. W. *The Australian Environment*. M.U.P.
Lemee, G. *Précis de Biogéographie*. Masson, Paris, 1967.
Moore, R. M. ed. *Australian Grasslands*. A.N.U.P.
Odum, E. P. *Ecology*. Holt, Rinehart & Winston, 1963.
Quezel, P. *La Vegetation du Sahara*. Fischer-Verlag. Stuttgart, 1966.
Richards, P. W. *The Tropical Rain Forest*. C.U.P., 1952.
Schnell, R. *Introduction a la Phytogéographie des Pays Tropicaux*. Vols. I and II. Gauthier-Villars. Paris, 1970.
Slatyer, R. O. & Perry, R. A. eds. *Arid Lands of Australia*. A.N.U.P.
Udvardy, M. D. F. *Dynamic Zoogeography*. Van Nostrand Reinhold, 1969.
Walter, H. *Ecology of Tropical and Subtropical Vegetation*. Mueller-Dombois, D. trans. Oliver & Boyd, 1972.
Walter, H. *Die Vegetation der Erde*. In Oko-Physiologisher Betrachtung. Vols. I (2nd ed.) and II. Jena, 1964 and 1968.
Watts, D. *Principles of Biogeography*. McGraw-Hill.

27.204 Advanced Biogeography

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, 1964.
Greig-Smith, P. *Quantitative Plant Ecology.* 2nd ed. Butterworths, 1964.
Usher, M. *Biological Management and Conservation: Ecological Theory, Application, Planning.* Chapman & Hall, 1972.

PRINCIPAL REFERENCE BOOKS

Brooks, R. R. *Geobotany and Biogeochemistry in Mineral Exploration.* Harper & Row, 1972.
Commoner, B. *The Closing Circle: Nature, Man and Technology.* Knopf, 1971.
Curtis, J. T. *The Vegetation of Wisconsin: an Ordination of Plant Communities.* Madison, 1959.
Duffey, E. & Watt, A. S. eds. *The Scientific Management of Animal and Plant Communities for Conservation.* Blackwell. Oxford, 1971.
Jeffers, J. N. R. *Mathematical Models in Ecology.* Blackwell, Oxford, 1972.
Kershaw, K. A., *Quantitative and Dynamic Ecology.* Arnold, 1964.
Lemee, G. *Précis de Biogéographie.* Masson. Paris, 1967.
May, J. M. *The Ecology of Human Disease.* M.D. Publications, N.Y., 1958.
Spedding, C. R. W. *Grassland Ecology.* O.U.P., 1972.
Stamp, L. D. *Some Aspects of Medical Geography.* O.U.P., 1964.
Watt, K. E. F. *Ecology and Resource Management: a Quantitative Approach.* McGraw-Hill, 1968.

27.303 Transportation Geography

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.

PRINCIPAL REFERENCE BOOKS

Blunden, W. *The Land-Use Transport System.* Pergamon.
Bunge, W. *Theoretical Geography.* Lund Studies in Geography.
Chorley, R. & Haggett, P. *Socio-economic Models in Geography.* Methuen.
Haggett, P. *Locational Analysis in Human Geography.* Arnold.

Haggett, P. *Network Analysis.* Arnold.
Hay, A. *Transport for the Space Economy.* Macmillan.
Kansky, K. J. *Structure of Transportation Networks.* University of Chicago, Dept. of Geography. Research Paper No. 84.
Mayer, J., Kain, J. F. & Wohl, M. *Urban Transportation Problems.* Harvard U.P.
Owen, W. *Strategy for Mobility.* Brookings.
Taaffe, E. & Gauthier, W. *Geography of Transportation.* Prentice-Hall.

27.304 Advanced Economic Geography

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.

TEXTBOOK

Richardson, H. *Regional Economics.* Weidenfeld & Nicolson.

PRINCIPAL REFERENCE BOOKS

Friedmann, J. *Regional Development Policy.* M.I.T. Press.
Friedmann, J. & Alonso, W. *Regional Development and Planning.* M.I.T. Press.
Goodall, B. *The Economics of Urban Areas.* Pergamon.
Hoover, E. *An Introduction to Regional Economics.* Knopf.
Isard, W. *Methods of Regional Analysis.* M.I.T. Press.
Perloff, H. S. *et al. Regions, Resources and Economic Growth.* Johns Hopkins U.P.
Siebert, H. *Regional Economic Growth: Theory and Policy.* Int. Textbook Co.
Smith, R. H. T., Taaffe, E. & King, L. *Readings in Economic Geography.* Rand McNally.
Thompson, W. *A Preface to Urban Economics.* Johns Hopkins U.P.

27.313 Location Analysis

Classical and more recent adaptations of location theory. Spatial competition and patterns of location with emphasis on the spatial distribution of resources and markets and their effects on the location of the firm. Decision theory relevant to location. Consideration of external economies, city and regional structure, growth pole and growth centre concepts, and regional development policies in workshop/seminars.

TEXTBOOK

Richardson, H. W. *Regional Economics.* Weidenfeld & Nicolson.

PRINCIPAL REFERENCE BOOKS

Alonso, W. *Location and Land Use.* Harvard U.P.
Beckmann, M. *Location Theory.* Random House.
Greenhut, M. *Plant Location in Theory and Practice.* N. Carolina U.P.
Hoover, E. *Location of Economic Activity.* McGraw-Hill.
Isard, W. *Location and Space Economy.* Wiley.
Lloyd, P. E. & Dicken, P. *Location in Space: A Theoretical Approach to Economic Geography.* Harper & Row.
Pred, A. *Behaviour and Location.* Lund U.P.
Smith, D. *Industrial Location.* Wiley.
Smith, R. H. T., Taaffe, E. & King, L. eds. *Readings in Economic Geography.* Rand McNally.

27.323 Marketing Geography

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.

PRINCIPAL REFERENCE BOOKS

Aaker, D. A. *Multivariate Analysis in Marketing.* Wadsworth.
Arndt, J. ed. *Insights into Consumer Behaviour.* Allyn & Bacon.
Bucklin, L. P. *Shopping Patterns in an Urban Area.* Inst. of Business and Econ. Research, University of Calif., Berkeley.
Clarkson, G. P. *The Theory of Consumer Demand.* Prentice-Hall.
Garner, B. J. *The Internal Structure of Retail Nucleations.* Northwestern University Studies in Geography, No. 12.
*Jenkins, J. R. G. *Marketing and Customer Behaviour.* Pergamon.
Kollatt, D. R., Blackwell, R. D. & Engel, J. F. *Research in Consumer Behavior.* Holt, Rinehart & Winston.
*Mulvihill, D. F. & R. C. *Geography, Marketing and Urban Growth.* Van Nostrand Reinhold.
Myers, J. G. *Consumer Image and Attitude.* Inst. of Business and Econ. Research, University of Calif., Berkeley.
Revzan, D. *Wholesaling in Marketing Organisation.* Wiley.
*Ryan, J. K. et al. *New Dimensions in Retailing: A Decision Oriented Approach.* Wadsworth.

27.333 Agricultural Geography

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

*Gregor, H. F. *Geography of Agriculture: Themes in Research.* Prentice-Hall.
*Morgan, W. B. & Munton, R. J. C. *Agricultural Geography.* Methuen.

PRINCIPAL REFERENCE BOOKS

*Anderson, R. *Crisis on the Land.* Sun Books.
Brookfield, H. C. ed. *The Pacific in Transition.* Arnold.
*Clout, H. *Rural Geography.* Pergamon.
Found, W. C. *A Theoretical Approach to Rural Land Use Patterns.* Arnold.
Green, R. J. *Country Planning.* Manchester U.P.

* Paperback.

*Hodder, B. W. *Economic Development in the Tropics.* 2nd ed. Methuen.
*James, P. G. *Agricultural Policy in the Wealthy Countries.* A. & R.
Kostrowicki, J. *Agricultural Geography.* Longman.
Leagans, J. P. & Loomis, C. P. eds. *Behavioral Change in Agriculture.* Cornell U.P.
*Meinig, D. W. *On the Margins of the Good Earth.* Seal.
Rogers, E. M. & Shoemaker, F. *Communication of Innovations.* Free Press.
Tarrant, J. R. *Agricultural Geography.* David & Charles.
Throsby, C. D. ed. *Agricultural Policy.* Penguin.
Weller, J. *Modern Agriculture and Rural Planning.* Architectural Press.
*Whitby, M. et al. *Rural Resource Development.* Methuen.
Williams, D. B. ed. *Agriculture in the Australian Economy.* Sydney U.P.

27.413 Geomorphology

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.* A.N.U.P.
Gregory, K J. & Walling, D. E. *Drainage Basin Form and Process.* Arnold.

PRINCIPAL REFERENCE BOOKS

Carson, M. A. & Kirkby, M. J. *Hillslope Form and Process.* C.U.P.
Chorley, R. J. ed. *Spatial Analysis in Geomorphology.* Methuen.
Chorley, R. J. ed. *Water, Earth and Man.* Methuen.
Chorley, R. J. & Kennedy, B. *Physical Geography: A Systems Approach.* Methuen.
Doornkamp, J. C. & King, C. A. M. *Numerical Analysis in Geomorphology.* Arnold.
King, C. A. M. *Beaches and Coasts.* Arnold.
Leopold, L. B., Wolman, M. G. & Miller, J. P. *Fluvial Processes in Geomorphology.* Freeman.
*Morisawa, M. *Streams: their Dynamics and Morphology.* McGraw-Hill.
Pitty, A. *Introduction to Geomorphology.* Methuen.
Schumm, S.A. ed. *River Morphology.* Dowden, Hutchinson & Ross.
Young, A. *Slopes.* Oliver & Boyd.

27.423 Pedology

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 four days field tutorials are an essential part of the course.

* Paperback.

TEXTBOOKS

Bridges, E. M. *World Soils.* C.U.P.
Corbett, J. R. *The Living Soil.* Martindale.

PRINCIPAL REFERENCE BOOKS

Alexander, M. *Introduction to Soil Microbiology.* Wiley.
Baver, L. D. *Soil Physics.* Wiley.
Bear, F. E. ed. *The Chemistry of the Soil.* Arnold.
Bear, F. E. *Soil in Relation to Crop Growth.* Reinhold.
Black, C. A. ed. *Soil-plant Relationships.* Wiley.
Buckman, H. O. & Brady, N. C. *The Nature and Properties of Soils.* Macmillan.
Clarke, G. C. & Beckitt, P. H. T. *The Study of the Soil in the Field.* O.U.P.
Northcote, K. H. *A Factual Key for the Recognition of Australian Soils.* Rellim.
Piper, C. S. *Soil and Plant Analysis.* Adelaide U.P.
Rose, C. W. *Agricultural Physics.* Pergamon.
Russell, E. W. *Soil Conditions and Plant Growth.* Longman.
Stace, H. C. T., *et al. A Handbook of Australian Soils.* Rellim.

27.404 Advanced Geomorphology and Pedology

The monitoring of process and change in, and application of model studies to hillslope, shoreline, fluvial and dune environments. Glacial and periglacial geomorphology. 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.

TEXTBOOK

Folk, R. L. *Petrology of Sedimentary Rocks.* Hemphills.

PRINCIPAL REFERENCE BOOKS

Allen, J. R. L. *Physical Process of Sedimentation.* Unwin.
Bagnold, R. A. *The Physics of Blown Sand and Desert Dunes.* Methuen.
Black, C. A. et al. *Methods of Soil Analysis.* Amer. Soc. Agronomy.
Brewer, R. *Mineral and Fabric Analysis of Soils.* Wiley.
Chorley, R. J., Dunn, A. J. & Beckinsale, R. F. *The History of the Study of Landforms.* Methuen.
Davies, J. L. *Landforms in Cold Climates.* A.N.U.P.
Doornkamp, J. C. & King, C. A. M. *Numerical Analysis in Geomorphology.* Arnold.
Embleton, C. & King, C. A. M. *Glacial and Periglacial Geomorphology.* Arnold.
Flint, R. F. *Glacial and Quaternary Geology.* McGraw-Hill.
Grim, R. E. *Clay Mineralogy.* McGraw-Hill.
King, C. A. M. *Beaches and Coasts.* Arnold.
King, C. A. M. *Techniques in Geomorphology.* Arnold.
Leopold, L. B., Wolman, M. G. & Miller, J. P. *Fluvial Processes Geomorphology.* Freeman.
Loughnan, F. C. *Chemical Weathering of Silicate Minerals.* Elsevier.
Mascon, B. *Principles of Geochemistry.* Wiley.

Ollier, C. D. *Weathering.* Oliver & Boyd.
Stace, G. T. et. al. *A Handbook of Australian Soils.* Rellim.
Tricort, J. *Geomorphology of Cold Environments.* Macmillan.

27.414 Advanced Geomorphology*

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*

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 systematic study which may be primarily geomorphic or pedologic, but with some interdisciplinary aspect.

To include a field element and a supporting laboratory programme.

27.801 Introduction to Physical Geography*

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.

* Not offered in 1975.

TEXTBOOK

Van Riper, J. E. *Man's Physical World.* McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Bird, E. F. C. *Coasts.* A.N.U.P.
Branagan, D. & Packham, G. *Field Geology of New South Wales.* Science Press.
Corbett, J. R. *The Living Soil.* Martindale.
Gentilli, J. *Sun, Climate and Life.* Jacaranda.
Ecological Society of Australia. *The City as a Life System.* Collected papers.
Twidale, C. R. *Geomorphology.* Nelson.
Twidale, C. R. & Foale, M. R. *Landforms Illustrated.* Nelson.

27.862 Australian Environment and Land Resources

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.* M.U.P.

PRINCIPAL REFERENCE BOOKS

Costin, A. B. & Frith, H. J. *Conservation.* Penguin.
Department of National Development. *Atlas of Australian Resources.* Dept. of Natl. Dev., Canberra.
Moore, R. M. ed. *Australian Grasslands.* A.N.U.P.
Sinden, J. A. ed. *The Natural Resources of Australia.* A. & R.
Slatyer, R. O. & Perry, R. A. *Arid Lands of Australia.* A.N.U.P.
Williams, D. B. ed. *Agriculture in the Australian economy.* Sydney U.P.

27.880 Geographic Statistics*

Additional quantitative research techniques taken by students in their third year. Research organization; computing including Fortran; collection and organization of data; statistical description; hypothesis testing and sampling; simple and multiple association analysis; nonparametric methods.

TEXTBOOKS

Blatt, J. M. *Introduction to Fortran IV Programming.* (Miditran Version). Computer Systems (Aust.).
King, L. J. *Statistical Analysis in Geography.* Prentice-Hall.

PRINCIPAL REFERENCE BOOKS

Aigner, D. J. *Basic Econometrics.* Prentice-Hall.
Doornkamp, J. C. & King, C. A. M. *Numerical Analysis in Geomorphology.* Arnold.
Krumbein, W. C. & Graybill, F. A. *An Introduction to Statistical Models in Geology.* McGraw-Hill.
Kerlinger, R. *Foundations of Social Research.* Holt, Rinehart & Winston.

* Not offered in 1975.

Nie, N. H. et al. *Statistical Package for the Social Sciences.* 2nd ed. McGraw-Hill. (Recommended to buy.)
Siegel, S. *Nonparametric Statistics for the Behavioral Sciences.* McGraw-Hill.
Sterling, T. D. & Pollack, S. V. *Introduction to Statistical Data Processing.* Prentice-Hall.
Veldman, D. J. *Fortran Programming for the Behavioral Sciences.* McGraw-Hill.

GEOGRAPHY GRADUATE SUBJECTS

27.901G Geomorphology for Hydrologists

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., and Miller, J. P. *Fluvial Processes in Geomorphology.* Freeman.
*Morisawa, M. *Streams.* McGraw-Hill.

PRINCIPAL REFERENCE BOOKS

Chorley, R. J. ed. *Spatial Analysis in Geomorphology.* Methuen, 1972.
Chorley, R. J. & Kennedy, B. A. *Physical Geography — A Systems Approach.* Prentice-Hall, 1971.
Chow, Ven Te. *Handbook of Applied Hydrology.* McGraw-Hill.
Dury, G. H. ed. *Rivers and River Terraces.* Macmillan.
Jennings, J. B. *Karst.* A.N.U.P., 1971.
King, C. A. M. *Techniques in Geomorphology.* Arnold.
Mabbutt, J. A. *et al. Lands of the Wiluna-Meekatharra Area, Western Australia.* CSIRO Land.Res. Series No. 7.
Stewart, G. A. ed. *Land Evaluation.* Macmillan, 1968.

27.902G Meteorological and Hydrological Principles

Part I. *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.

Part II. *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.

* Paperback.

PRINCIPAL REFERENCE BOOKS

Commonwealth Bureau of Meteorology. *Manual of Meteorology*, 1966.
Shields, A. J. *Australian Weather*. Jacaranda.
Chow, Ven Te. *Handbook of Applied Hydrology*. McGraw-Hill.
Bruce, J. P. & Clark, R. H. *Introduction to Hydrometeorology*. Pergamon.
Proceedings of Clean Air Conference, 1965. N.S.W.U.P.

27.904G Geomorphology for Engineering Geologists

Landform expression of lithology and structure. Hill slope 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

Selby, M. J. *Slopes and Slope Processes*. N.Z. Geog. Soc., 1970.
Thornbury, W. D. *Principles of Geomorphology*. Wiley, 1969.

PRINCIPAL REFERENCE BOOKS

Bird, E. F. C. *Coasts*. A.N.U.P., 1968.
CSIRO. *Lands of the Queanbeyan-Shoalhaven Area, A.C.T. and N.S.W.* Land Research Series No. 24, 1969.
Davies, J. L. *Geographical Variation in Coastal Development*. Oliver & Boyd, 1972.
Grant, K. *A Terrain Evaluation System for Engineering*. CSIRO Division of Soil Mechanics, Tech. Paper No. 2, 1968.
Grant, K. *Terrain Classification for Engineering Purposes of the Melbourne Area*. CSIRO Division of Applied Geomechanics, Tech. Paper No. 11, 1972.
King, C. A. M. *Techniques in Geomorphology*. Arnold, 1966.
Stewart, G. A. ed. *Land Evaluation*. Macmillan, 1968.
Thomas, W. L. ed. *Man's Role in Changing the Face of the Earth*. Chicago U.P., 1956.
Young, A. *Slopes*. Oliver & Boyd, 1972.

SCHOOL OF MARKETING

28.012 Marketing Systems

An introduction to Marketing from various perspectives. Marketing is looked at 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, 1974.

28.022 Marketing Models

Students are introduced to the use of quantitative analysis in marketing decision-making in business situations. The derivative (pricing for profit maximization, inventory policy for cost minimization); linear programming (designing programmes 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 programme 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, 1967.

PRINCIPAL REFERENCE BOOKS

Churchman, C. W., Ackoff, R. L. & Arnoff, E. L. *Introduction to Operations Research*. Wiley, 1957.

Clark, W. A. & Sexton Jr., D. E. *Marketing and Management Science: A Synergism*. Irwin, 1970.

Frank, R. E., Kuehn, A. A. & Massy, W. F. eds. *Quantitative Techniques in Marketing Analysis*. Irwin, 1962.

Miller, D. W. & Starr, M. K. *Executive Decisions and Operations Research*. Prentice-Hall, 1960.

Sasieni, M., Yaspan, A. & Friedman, L. *Operations Research Methods and Problems*. Wiley, 1959.

28.032 Behavioural Science

The course introduces major concepts and research in the behavioural sciences in order to reveal the dynamics of human behaviour and the variety of viewpoints that can be adopted in explaining behaviour. It covers the following areas: 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

Engel, J. F., Kollat, D. T. & Blackwell, T. S. *Consumer Behaviour*. Holt, Rinehart & Winston, 1968.

Kassarjian, H. H. & Robertson, T. S. eds. *Perspectives in Consumer Behaviour*. Scott, Foresman, 1968.

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 and Winston, 1968.

Kassarjian, H. H. & Robertson, T. S. eds. *Perspectives in Consumer Behaviour.* Rev. ed. Scott, Foresman, 1968.

SCHOOL OF SURVEYING

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, 1972.
Seven Figure Mathematical Tables. Chambers, 1958 (full edition).

PRINCIPAL REFERENCE BOOKS

Admiralty Manual of Hydrographic Surveying. Vol. I. Surveying on Shore. Hydrographic Department of the Navy, London, 1965.
Birchal, H. F. *Modern Surveying for Civil Engineers.* 2nd ed. Chapman & Hall, 1955.
Brinker, R. C. & Taylor, W. C. *Elementary Surveying.* 4th ed. Int. Textbook Co., 1964.
Clark, D. *Plane and Geodetic Surveying.* Vol. I. 6th ed. Constable, 1969.
Clark, D. *Plane and Geodetic Surveying.* Vol. II. 5th ed. Constable, 1963.
Hickerson, T. F. *Route Location and Design.* 5th ed. McGraw-Hill, 1967.
Sandover, J. A. *Plane Surveying.* Arnold, 1961.
Whyte, W. S. *Basic Metric Surveying.* Butterworths, 1969.

29.491 Survey Camp

A one-week field camp for students studying 29.441 Engineering Surveying.

* Paperback.

SCHOOL OF TOWN PLANNING

36.411 Town Planning

The study of factors influencing the direction of the development and use of land in the public interest. Objectives of town and regional planning; the urban planning process; patterns and processes of urbanization; the industrial and urban revolution; housing and neighbourhood planning; civic design; planning law and administration; the Sydney Region Outline Plan; action plans; industrial location and decentralization; "Tomorrow's Canberra"; the future city.

PRINCIPAL REFERENCE BOOKS

Abercrombie, P. *Town and Country Planning.* 3rd ed. O.U.P., London, 1959.
Brown, A. J. and Sherrard, H. M. *An Introduction to Town and Country Planning.* 2nd ed. A. & R., Sydney, 1969.
Colman, J. *Planning and People.* A. & R.
Mumford, L. *The City in History.* Secker & Warburg.
Rose, A. J. *Patterns of Cities.* Nelson.
Stretton, H. *Ideas for Australian Cities.* Griffin Press.

SCHOOL OF BIOCHEMISTRY

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.

TEXTBOOKS

Montgomery, R. & Swenson, C. A. *Quantitative Problems in the Biological Sciences.* Freeman, 1969.

White, A., Handler, R., & Smith, E. L. *Principles of Biochemistry.* 5th ed. McGraw-Hill, 1973.

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.

TEXTBOOKS

As for 41.101A, plus

McGilvery, R. W. *Biochemistry: A Functional Approach.* Saunders, 1970.

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 41.101B.

PRINCIPAL REFERENCE BOOK

Frieden, E. & Lipner, H. *Biochemical Endrocrinology of the Vertebrates.* Prentice-Hall, 1971.

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

Barker, R. *Organic Chemistry of Biological Compounds.* 1st ed. Prentice-Hall, 1971.

Scientific American. *The Chemical Basis of Life. An Introduction to Molecular and Cell Biology.* Freeman, 1973.

White, A., Handler, R., & Smith, E. L. *Principles of Biochemistry.* 5th ed. McGraw-Hill, 1973 *or*

Lehninger, A. L. *Biochemistry: The Molecular Basis of Cell Structure and Function.* Worth Publishers, 1970.

Wold, F. *Macromolecules: Structure and Function.* Prentice-Hall, 1971.

PRINCIPAL REFERENCE BOOKS

Bernhard, S. *The Structure and Function of Enzymes.* Benjamin, 1968.
Davidson, J. N. *The Biochemistry of the Nucleic Acids.* 7th ed. Methuen, 1972.
Watson, J. D. *The Molecular Biology of the Gene.* 2nd ed. Benjamin, 1970.

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 41.102, plus
Frieden, E. & Lipner, H. *Biochemical Endocrinology of the Vertebrates.* 1st ed. Prentice-Hall, 1971.

PRINCIPAL REFERENCE BOOK

McGilvery, R. W. *Biochemistry: A Functional Approach.* 1st ed. Saunders, 1970.

SCHOOL OF BIOLOGICAL TECHNOLOGY

42.102 Fermentation Technology

An introduction to 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 standardisation of products; process optimisation; 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, 1973.
Casida, L. E. Jr. *Industrial Microbiology.* Wiley, 1968.
Kubitschek, H. E. *Introduction to Research with Continuous Cultures.* Prentice-Hall, 1970.

PRINCIPAL REFERENCE BOOKS

Blakebrough, N. ed. *Biochemical and Biological Engineering Science.* Vols. 1 & 2. Academic, 1968.
Ghosh, T. & Fiechter, A. *Advances in Biochemical Engineering.* Springer-Verlag, 1971.
Rhodes, A. & Fletcher, D. *Principles of Industrial Microbiology.* Pergamon, 1966.
Solomons, G. L. *Materials and Methods in Fermentation.* Academic, 1969.
Webb, F. C. *Biochemical Engineering.* Van Nostrand, 1964.

BIOLOGICAL TECHNOLOGY GRADUATE SUBJECTS

42.211G Principles of Biology

A study of the characteristics of living systems—including a functional treatment of cytology, metabolism, bioenergetics; structure, function and characteristics of single and multicellular systems; growth; cell division; reproduction; heredity and evolution.

TEXTBOOK

Villee, C. A. *Biology.* 6th ed. Saunders, 1972.

PRINCIPAL REFERENCE BOOKS

Loewy, A. G. & Siekevitz, P. *Cell Structure and Function.* 2nd ed. Holt, Rinehart & Winston, 1970.
Conn, E. E. & Stumpf, P. K. *Outlines of Biochemistry.* 3rd ed. Wiley, 1972.

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, 1972.

PRINCIPAL REFERENCE BOOKS

Karlson, P. *Introduction to Modern Biochemistry*. 4th ed. Academic, 1974.

Mahler, H. R. & Cordes, E. H. *Biological Chemistry*. 2nd ed. Harper & Row, 1971.

42.213G Biochemical Methods

A laboratory programme 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, 1969.

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, 1965.

Casida, L. E. Jr. *Industrial Microbiology*. Wiley, 1968.

Kubitschek, H. E. *Introduction to Research with Continuous Cultures*. Prentice-Hall, 1970.

PRINCIPAL REFERENCE BOOKS

Blakebrough, N. ed. *Biochemical and Biological Engineering Science*. Vols. 1 & 2. Academic, 1968.

Ghosh, T. & Fiechter, A. *Advances in Biochemical Engineering*. Springer-Verlag, 1971.

Rhodes, A. & Fletcher, D. *Principles of Industrial Microbiology*. Pergamon, 1966.

Solomons, G. L. *Materials and Methods in Fermentation*. Academic, 1969.

Webb, F. C. *Biochemical Engineering*. Van Nostrand, 1964.

SCHOOL OF BOTANY

43.101 Genetics

Various aspects of molecular, organismal and population genetics, including: meiotic and non-meiotic recombination, genome variations, mutagens and mutation rates, cytoplasmic inheritance, gene function, genetic code, gene structure, collinearity of polynucleotide and polypeptide, control of gene action, genes and development, population genetics, genetics and improvement of plants and animals.

TEXTBOOK

Srb, A. M., Owen, R. D. & Edgar, R. S. *General Genetics.* 2nd. ed. Freeman, 1965.

43.111 Plant Evolution and Ecology

A study of the evolution of vegetative form and structure of vascular plants; an examination of their organisation into terrestrial communities; identification, evolution and distribution of elements of the Australian flora. Students will be required to attend field excursions, all of which form an integral part of the course.

TEXTBOOKS

Beadle, N. C. W., Evans, O. E., & Carolin, R. C. *Flora of the Sydney Region.* Reed, 1972.

Fahn, A. *Plant Anatomy.* Pergamon, 1967.

References for the plant ecology section of this unit will be supplied during the course.

43.112 Plant Taxonomy

Considers the assessment, analysis and presentation of data for classifying plants both at the specific and supra-specific level. Some field excursions are necessary.

TEXTBOOKS

Beadle, N. C. W., Carolin, R. C. & Evans, O. D. *Handbook of the Vascular Plants of the Sydney District and Blue Mountains.* 1962.

Cronquist, A. *The Evolution and Classification of Flowering Plants.* Nelson, 1968.

Sporne, K. R. *The Morphology of the Gymnosperms.* Hutchinson, 1967.

43.121 Plant Physiology

A general introduction to the physiology of the whole plant including a consideration of photosynthesis, inorganic nutrition, transport, translocation, physiology of growth and development, and plant growth substances and their application in agriculture.

TEXTBOOKS

Galston, A. W. & Davies, P. J. *Control Mechanisms in Plant Development.* Prentice-Hall, 1970.

Richardson, M. *Translocation in Plants.* Arnold, 1968.

Sutcliffe, J. *Plants and Water.* Arnold, 1968.

Whittingham, C. P. *Photosynthesis.* O.U.P., 1971.

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

44.111 Microbiology

This is a similar course to 44.101 but is modified in its treatment to suit 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.

TEXTBOOK

Brock, T. D. *Biology of Microorganisms.* Prentice-Hall, 1970.

or

Pelczar, M. J. & Reid, R. D. *Microbiology,* 3rd ed. McGraw-Hill.

44.141 Introductory Microbiology for Food Technologists

Prerequisite: 17.001.

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.

TEXTBOOK

Brock, T. D. *Biology of Microorganisms.* Prentice-Hall, 1970.

or

Stanier, R. Y., Doudoroff, M. & Adelberg, E. A. *General Microbiology.* 3rd ed. Macmillan, 1971 (also published as *The Microbial World.* 3rd ed. Prentice-Hall, 1970).

or

Hawker, L. E. & Linton, A. H. eds. *Micro-organisms: Function, Form and Environment.* Arnold, 1971.

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 will be continuous and grading based upon the number of objectives achieved.

TEXT AND PRINCIPAL REFERENCE BOOKS

No set texts, but specific reading assignments will be given.

SCHOOL OF SOCIOLOGY

53.101 Sociology 1A

An introduction to sociology, with particular reference to the history and development of social thought. Students will be 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.

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, e.g., 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.

58.513 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

Students elect 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 programme. *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. Empathy, role playing, and sensitivity training in the classroom.

OPTIONS IN PHILOSOPHY AND THEORY OF EDUCATION

Aesthetics and Education: Aesthetics in education at both theoretical and practical levels, objectivity in aesthetics and the place of aesthetics in the curriculum. *Ethical Theory and Moral Education:* An attempt to bring together philosophy and education by examining the questions raised by major standpoints in ethics and the difficulties faced in justifying them; and by relating these to ideas and practices in 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 will not duplicate material covered in curriculum and instruction strands). *Methodology for Criticism in Education:* The nature of educational theory and the methods and perspectives that might follow for discussion and criticism in education. Examinations, discipline and punishment, the organization of secondary schools, compulsory education, motivation, the subject curriculum, equality of opportunity. Students have an opportunity to suggest other issues. *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.

OPTION IN RESEARCH METHODS IN EDUCATION

Educational Research II: This option 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 Minority Groups:* The education of minority groups in Australia, in particular migrants and aborigines.

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STUDENT'S TIMETABLE

Time	Monday	Tuesday	Wednesday	Thursday	Friday
9-10					
10-11					
11-12					
12-1					
1-2					
2-3					
3-4					
4-5					
5-6					
6-7					
7-8					
8-9					

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The Deputy Registrar (Student Services), Mr. P. O'Brien, is located on the first floor of the Chancellery. See Mr. O'Brien or Mr. S. Briand for matters relating to *financial problems* (he may be able to arrange a loan). 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* contact Mr. J. Grigg (Phone 2143). This section can also advise on matters relating to *discontinuation of subjects* and *termination of courses.*

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 2485.

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.

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. Library enquiries should be directed to 2649.

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 3 of the Union where the SU full-time President or Education vice-President are available to discuss any educational problems you might have. In addition to dispensing free educational advice the SU offers a diverse range of 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, Speer, Concessions Book and counter course handbooks. For information about these phone 2929.

This Handbook has been specially designed as a source of reference for you and will prove useful for consultation throughout the year at this University.

For fuller details about the University—its organization, staff membership, description of courses and so on, you should consult the University 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 General Studies.

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 between one dollar and $1.50 (plus 20 cents postage), with the exception of General Studies, which is available free of charge.

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