FACULTY OF APPLIED SCIENCE

1972 HANDBOOK

THE UNIVERSITY OF NEW SOUTH WALES

80 CENTS

FACULTY OF APPLIED SCIENCE

1972 HANDBOOK

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THE UNIVERSITY OF NEW SOUTH WALES

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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, 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.

CALENDAR OF DATES FOR 1972

Session 1: March 6 to May 13

May Recess: May 14 to May 21

May 22 to June 17

Midyear Recess: June 18 to July 23

Session 2: July 24 to August 12

August Recess: August 13 to August 27

August 28 to November 11

JANUARY

Friday 21	Last day for acceptance of applications to enrol by new students and students repeating first year
Monday 31	Australia Day—Public Holiday

FEBRUARY

Tuesday 1 to Saturday 12	Deferred examinations
Monday 21	Enrolment period begins for new students and students repeating first year
Monday 28	Enrolment Week commences for students re-enrolling (second and later years)

MARCH

Monday 6	**Session 1 commences**
Friday 17	Last day of enrolment for new students (late fee payable)
Thursday 30	Last day for later year enrolments (late fee payable)
Friday 31 to Monday, 3 April	Easter

APRIL

Tuesday 25	Anzac Day—Public Holiday

MAY

Sunday 14 to Sunday 21	May Recess

JUNE

Monday 12	Queen's Birthday—Public Holiday
Tuesday 13	Midyear examinations begin
Saturday 17	**Session 1 ends**
Friday 30	Last day for acceptance of applications for re-admission after exclusion under rules governing re-enrolment

JULY

Saturday 1 ..... Midyear examinations end
Monday 24 ..... **Session 2 commences**
Thursday 27 ..... Foundation Day

AUGUST

Sunday 13 to
Sunday 27 ..... August Recess

SEPTEMBER

Friday 15 ..... Last day for acceptance of corrected enrolment details forms

OCTOBER

Monday 2 ..... Eight Hour Day—Public Holiday
Friday 6 ..... Last day for acceptance of corrected enrolment details forms (late fee payable)

NOVEMBER

Saturday 11 ..... **Session 2 ends**
Tuesday 14 ..... Examinations begin

1973

Session 1: March 5 to May 12

May Recess: May 13 to May 20

May 21 to June 16

Midyear Recess: June 17 to July 22

Session 2: July 23 to August 11

August Recess: August 12 to August 26

August 27 to November 10

JANUARY

Tuesday 30 to
Saturday 10 Feb. .... Deferred examinations

FEBRUARY

Monday 19 ..... Enrolment Week commences for new students and students repeating first year
Monday 26 ..... Enrolment Week commences for students re-enrolling (second and later years)

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. In addition there are short recesses within the sessions—one week within Session 1 and two weeks within Session 2.

The first session commences on the first Monday of March.

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CHAIRMAN—Professor R. T. Fowler
ADMINISTRATIVE OFFICER—Dr. J. D. Collins

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REQUIREMENTS FOR ADMISSION

A person who seeks to become a candidate for any degree of Bachelor of the University must first have qualified for matriculation and have satisfied the requirements for admission to the particular Faculty, course or subject chosen.

In addition to complying with these conditions candidates must be selected before being permitted to enrol in a course. In 1972 it will be necessary for the University to limit the number of students enrolling in all undergraduate courses.

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

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

MATRICULATION REQUIREMENTS

Section A

General Matriculation and Admission Requirements

1. A candidate may qualify for matriculation by attaining in recognized matriculation subjects at one New South Wales Higher School Certificate Examination or at one University of Sydney Matriculation Examination a level of performance determined by the Professorial Board from time to time.

2. The level of performance required to qualify for matriculation shall be

(a) passes in at least five recognized matriculation subjects, one of which shall be English and three of which shall be at Level 2 or higher; and

(b) the attainment of an aggregate of marks, as specified by the Professorial Board, in not more than five recognized matriculation subjects, such marks being co-ordinated in a manner approved by the Board.

3. The following subjects, and such other subjects as may be approved by the Professorial Board from time to time, shall be recognised matriculation subjects:—

English	Greek	Chinese
Mathematics	Latin	Japanese
Science	French	Hebrew
Agriculture	German	Dutch
Modern History	Italian	Art
Ancient History	Bahasa Indonesia	Music
Geography	Spanish	Industrial Arts
Economics	Russian	

4. A candidate who has qualified to matriculate in accordance with the provisions of Clauses 1, 2 and 3 may be admitted to a particular Faculty, Course or Subject provided that:—

(a) his qualification includes a pass at the level indicated in the subject or subjects specified in Schedule A as Faculty, Course or Subject Pre-Requisites; or

(b) the requirements regarding these particular Faculty, Course or Subject Pre-Requisites, as specified in Schedule A, have been met at a separate Higher School Certificate or University of Sydney Matriculation Examination.

5. Notwithstanding any of the provisions of Clauses 1 to 4, the Professorial Board may grant matriculation status to any candidate at the Higher School Certificate or University of Sydney Matriculation Examination who has reached an acceptable standard and may admit him to any Faculty, Course or Subject.

NOTE

1. For the purposes of clause 2(a), Mathematics and Science BOTH PASSED at First Level or Second Level Full Course shall together count as three subjects.
2. For the purposes of clause 2(b), Mathematics and Science TAKEN either singly or together at first level or second level full course shall each count as one and one half subjects.

Schedule A

FACULTY OR COURSE	FACULTY OR COURSE PRE-REQUISITES
Applied Science (excl. Applied Geography and Wool and Pastoral Sciences courses) Biological Sciences Engineering Industrial Arts Course Medicine Military Studies (Engineering course and Applied Science course) Science Bachelor of Science (Education)	(a) Science at Level 2S or higher AND (b) either Mathematics at Level 2F or higher OR Mathematics at Level 2S, provided that the candidate's performance in this subject and his general level of attainment are at standards acceptable to the Professorial Board.
Architecture Applied Geography and Wool and Pastoral Sciences courses (Faculty of Applied Science)	(a) Science at Level 2S or higher AND (b) Mathematics at Level 2S or higher
Arts Social Work Degree Course	English at Level 2 or higher
Commerce	(a) Mathematics at Level 2S or higher AND (b) either English at Level 2 or higher OR English at Level 3, provided that the candidate's performance in this subject and his general level of attainment are at standards acceptable to the Professorial Board.
Law Combined Arts/Law Combined Commerce/Law Combined Jurisprudence/Law	Nil As for Arts As for Commerce Nil
Military Studies (Arts Course)	English at Level 2 or higher OR English at Level 3, provided that the candidate's performance in this subject and his general level of attainment are at standards acceptable to the Professorial Board, and provided that a candidate so qualified shall not enrol in a course of English literature.

SUBJECT	SUBJECT PRE-REQUISITES
1.011—Higher Physics I 1.001—Physics I 1.041—Physics IC	As for Faculty of Science
2.001—Chemistry I 17.001—General and Human Biology 25.001—Geology I 25.111—Geoscience I	Science at Level 2S or higher
10.011—Higher Mathematics I	Mathematics at Level 2F or higher
10.001—Mathematics I	Either Mathematics at Level 2F or higher OR Mathematics at Level 2S, provided that the candidate's performance in the subject and his general level of attainment are at standards acceptable to the Professorial Board.
10.021—Mathematics IT	Mathematics at Level 2S or higher
15.102—Economics II	As for Faculty of Commerce
50.111—English I 51.111—History IA 51.121—History IB	English at Level 2 or higher
56.111—French I	French at Level 2 or higher
59.111—Russian I	Russian at Level 2 or higher
64.111—German I	German at Level 2 or higher
65.111—Spanish I	Spanish at Level 2 or higher
59.001—Russian IZ 64.001—German IZ 65.001—Spanish IZ	A foreign language, other than that in which enrolment is sought, at Level 2 or higher

ADMISSIONS AND ENROLMENT PROCEDURE

ADMISSIONS PROCEDURE

Details of the procedure to be followed by students seeking entry to first year courses at the University may be obtained from the Admissions Office or the Metropolitan Universities Admissions Centre.

Persons seeking entry to first year courses in one or more of the three Universities in the Sydney Metropolitan Area (Macquarie University, The University of New South Wales and the University of Sydney) are required to lodge a single application form with the Metropolitan Universities Admissions Centre, Third Floor, 13-15 Wentworth Avenue, Sydney (near Liverpool Street). Postal address: Box 7049, G.P.O., Sydney, 2001. Telephone: 26 6301. On the application form provision is made for applicants to indicate preferences for courses available in any of the three Universities. Students are notified individually of the result of their applications and provided with information regarding the procedures to be followed in accepting the offer of a place at this University and completing their enrolment at the Enrolment Bureau, Unisearch House, 221 Anzac Parade, Kensington.

ADMISSIONS OFFICE

The Admissions Office which is located in the Chancellery on the upper campus provides intending students (both local and overseas) with information regarding courses, admission requirements, scholarships and enrolment. Office hours are from 9.00 a.m. to 1.00 p.m. and 2.00 p.m. to 5.00 p.m. Monday to Friday. During the enrolment period, an evening service is also provided.

Applications for special admission, admission with advanced standing and from persons relying for admission on overseas qualifications should be lodged with the Admissions Office. The Office also receives applications from students who wish to transfer from one course to another, resume their studies after an absence of twelve months or more, or seek any concession in relation to a

course in which they are enrolled. It is essential that the closing dates for lodgment of applications are adhered to, and, for further details the sections on "Rules Relating to Students" and "Enrolment Procedure for Undergraduate Courses" should be consulted.

ENROLMENT PROCEDURE

In 1972 it will be necessary for the University to impose quotas in each Faculty and Board of Studies.

The enrolment procedure for the different classes of undergraduate students is as follows:

First Enrolments

(a) New South Wales residents already qualified for admission and persons who are applying for enrolment on the basis of qualifications gained or about to be gained outside New South Wales must lodge an application for enrolment with the Metropolitan Universities Admissions Centre, 13-15 Wentworth Avenue, Sydney (P.O. Box 7049 G.P.O., Sydney) by 29th October, 1971.

(b) New South Wales residents qualifying for admission by the 1971 New South Wales Higher School Certificate Examination or the 1972 Sydney University Matriculation Examination and those who have attended a University in New South Wales in 1971 must apply for enrolment to the Metropolitan Universities Admissions Centre, 13-15 Wentworth Avenue, Sydney (P.O. Box 7049 G.P.O., Sydney) by 21st January, 1972.

Students whose applications for enrolment are accepted will be required to complete their enrolment at a specified appointment time before the beginning of Session 1. Course details must be completed and fees must be paid on the day of the appointment. However, in special circumstances and provided class places are still available, students may be allowed to complete their enrolment after the prescribed week subject to the payment of a late fee.

Failure in First Year. First year students who failed more than half their programme at the 1971 Annual Examinations and who were not granted any deferred examinations will NOT follow the above procedure. They are required to 'show cause' why they should be allowed to continue in the course, and should await instructions in writing from the Registrar as to the procedure.

Later Year Enrolments. All students enrolling other than for the first time and not included above should enrol through the appropriate School, bringing with them their notification of examination results for the previous year. This enrolment must be effected before or during the week preceding the beginning of Session 1, in accordance with the special arrangements made by the individual schools.

Students who have completed the final examinations but have a thesis still outstanding are required to enrol for the period necessary to complete the thesis and to pay the requisite fees.

Miscellaneous Subject Enrolments. Students may be permitted to enrol for miscellaneous subjects (i.e., as students not proceeding to a degree or diploma) provided the Head of the School offering the subject considers it will be of benefit to the student and there is accommodation available. Only in exceptional cases will subjects taken in this way count towards a degree or diploma. Where a student is under exclusion he may not be enrolled in miscellaneous subjects unless given approval by the Professorial Board.

Final Dates for Completion of Enrolment. No enrolments will be accepted from *new students* after the end of the second week of Session 1 (17th March, 1972) except with the express approval of the Registrar and the Head of the School concerned; no *later year enrolments* will be accepted after 31st March without the express approval of the Registrar which will be given in exceptional circumstances only.

University Union Card

All students other than miscellaneous students are issued with a University Union membership card. This card must be carried during attendance at the University and shown on request.

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

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

year and returned. Failure to present the card could result in some inconvenience in completing re-enrolment.

A student who loses a Union card must 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 practicable after payment of fees. In the meantime, 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.

UNDERGRADUATE COURSE FEES

Where course fees are assessed on the basis of session hours of attendance the hours of each subject for purposes of fee assessment shall be those prescribed in the Calendar, irrespective of any variation from the prescribed hours which may be necessary in conducting the subject.

Fee determination for courses in the Faculty of Applied Science is on a session basis. **Fees quoted in this schedule are current at the time of publication and may be amended by the Council without notice.**

A full-time course fee will be charged for any session where more than 15 hours' per week instruction, etc., is involved.

(i) Full-time Course Fee (more than 15 hours' attendance per week)—$231 per session.

(ii) Part-time Course Fee—over 6 hours' and up to 15 hours' attendance per week—$115.50 per session.

(iii) Part-time Course Fee—6 hours' or less attendance per week—$57.50 per session.

(iv) Course Continuation Fee—A fee of $33 per annum (no session payment) is payable by:

Category (a) students who have once been enrolled for a thesis and have only that requirement outstanding, *or*

Category (b) students given special permission to take annual examinations without attendance at the University. (Students in this category are not required to pay the subscriptions to the University Union, the Students' Union, the Sports Association and the Library Fee.)

Miscellaneous Subjects

Undergraduate subjects taken as "miscellaneous subjects" (i.e., not for a degree or diploma) or to qualify for registration as a candidate for a higher degree are assessed on an hourly basis in accordance with the schedule above.

Students given approval to enrol in a miscellaneous subject or subjects in addition to being enrolled in a course are assessed according to the total hours of attendance as if the additional subject formed part of the course.

OTHER FEES

In addition to the course fees set out above all registered undergraduates will be required to pay—

Matriculation Fee—$9—payable at the beginning of first year.

Library Fee—annual fee—$16.

University Union—$20—entrance fee.

Student Activities Fees

University Union*—$30—annual subscription.
Sports Association*—$4—annual subscription.
Students' Union*—$6—annual subscription.
Miscellaneous—$17—annual fee.

Graduation or Diploma Fee—$9 payable at the completion of the course.

Depending on the course being taken, students may also be required to pay—

Applied Psychology Kit Hiring Charge—$2 per kit. Additional payment for breakages and losses in excess of $1.

Biochemistry Kit Hiring Charge—$4 per kit. Additional charge for breakages and losses in excess of $1 may be required.

Chemistry Kit Hiring Charge—$4 per kit. Additional charge for breakages and losses in excess of $1 may be required.

Excursion Fee—$2 per subject (plant morphology, plant taxonomy, environmental botany).

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

Special Examination Fees

Deferred examination—$7 for each subject.

Examinations conducted under special circumstances—$9 for each subject.

Review of examination result—$9 for each subject.

LATE FEES

First Enrolments

Fees paid at the late enrolment session and before the commencement of Session 1	$8
Fees paid during the first and second weeks of Session 1	$16
Fees paid after the commencement of the third week of Session 1 with the express approval of the Registrar and Head of the School concerned	$33

Re-Enrolments

Session 1

Failure to attend enrolment centre during enrolment week	$8
Fees paid after the commencement of the third week of Session 1 to 31st March	$16
Fees paid after 31st March where accepted with the express approval of the Registrar	$33

Session 2—All enrolments

Fees paid in third and fourth weeks of Session 2	$16
Fees paid thereafter	$33
Late lodgement of corrected enrolment details forms (late applications will be accepted for three weeks only after the prescribed dates)	$7

WITHDRAWAL FROM COURSE

Students withdrawing from a course are required to notify the Registrar in writing. Fees for the course accrue until a written notification is received.

PAYMENT OF FEES

Completion of Enrolment

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 late fee of $8.

First year students (including students repeating first year) must complete enrolment (including fee payment) before they are issued with class timetables or permitted to attend classes. A first year student who has been offered a place in a course to which entry is restricted and fails to complete enrolment (including fee payment) at the appointed time may lose the place allocated.

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 earlier.) 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) from new students after the end of the second week of Session 1 (i.e., 17th March, 1972), 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.

Payment of Fees by Session

Students who are unable to pay their fees by the year may pay by the session, in which case they are required to pay Session 1 course fees and other fees for the year, within the first two weeks of Session 1. Students paying under this arrangement will receive accounts from the University for Session 2 fees. These fees must be paid within the first two weeks of Session 2.

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 will be made when the enrolment voucher or letter of authority is subsequently lodged with the Cashier.

* The enrolment periods for Sydney students are prescribed annually in the leaflets "Enrolment Procedure for New Students" and "Enrolment Procedure for Students Re-enrolling".

Extension of Time

Any student who is unable to pay fees by the due date may apply in writing to the Registrar for an extension of time. Such application must state year or stage, whether full-time or part-time, and the course in which the applicant wishes to enrol, describe clearly and fully the reasons why payment cannot be made and the extension sought, 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 until 31st March for fees due in Session 1 and for one month from the date on which a late fee becomes payable in Session 2.

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

Failure to Pay Fees

Any student who is 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 membership and privileges of the University. 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 course fees for the year is outstanding after the end of the fourth week of Session 2 (18th August, 1972).

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.

Cashier's Hours

The Cashier's office is open for the payment of fees 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 three weeks of each session.

GENERAL RULES AND INFORMATION

GENERAL CONDUCT

Acceptance as a member of the University implies an undertaking on the part of the student to observe the regulations, by-laws and other requirements of the University, in accordance with the declaration signed at the time of the enrolment.

In addition, students are expected to conduct themselves at all times in a seemly fashion. Smoking is not permitted during lectures, in examination rooms or in the University Library. Gambling is also forbidden.

ATTENDANCE AT CLASSES

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

Where a student has failed a subject at the annual examinations in any year and re-enrols in the same course in the following year, he must include in his programme of studies for that year the subject in which he has 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.

Where a student has attended less than eighty per cent of the possible classes, he may be refused permission to sit for the examination in that subject.

INDEBTEDNESS TO THE UNIVERSITY

Any student who is 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 membership and privileges of the University. Such a student is not permitted to register for a further session, to attend classes or examinations, or to be granted any official credentials.

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

COURSE TRANSFERS

Students wishing to transfer from one course to another must apply on an application form obtainable from the Admissions Office, Chancellery, by Friday, 21st January. As quotas will operate on entry to all Faculties and the Board of Vocational Studies in 1972, failure to apply by 21st January 1972 will most likely result in the application for transfer being unsuccessful.

Students whose applications to transfer are successful are required to comply with the enrolment procedures for the year/stage of the new course in which they expect to enrol. Unless otherwise instructed they must present the letter granting approval of the transfer to the enrolling officer.

Students who have not received advice regarding their application to transfer before the date on which they are required to enrol should check with the Admissions Office.

Students should also advise the Enrolling Officer of the School in which they are enrolled of their intention to transfer.

CHANGES IN COURSE PROGRAMMES AND WITHDRAWAL FROM SUBJECTS

Students seeking approval to substitute one subject for another, add one or more subjects to their programme or discontinue part of their programme must make application to the Head of the School responsible for the course on a form available from School offices. Any addition or substitution of subjects after 31st March will be accepted only with the express approval of the Registrar on the recommendation of the appropriate Head of School, and will be given in exceptional circumstances only. In the case of students wishing to terminate their enrolment the application must be lodged at the Examinations and Student Records Section. The Registrar will inform students of the decision. Approval of withdrawal from subjects is not automatic, each application being determined after considering the circumstances advanced as justifying withdrawal.

It is emphasized that withdrawal from:

(1) a subject, tuition in which extends over the academic year, at any time after the May recess;
(2) a subject, tuition in which extends over only one session, at any time after one month from the commencement of the subject; *or*
(3) failure to sit for the examinations in any subject in which the student has enrolled

shall be regarded as failure to satisfy the examiners in the subject, unless written approval to withdraw without failure has been obtained from the Registrar.

RESUMPTION OF COURSES

Students wishing to resume their studies after an absence of twelve months or more are required to apply to the Admissions Office for permission to re-enrol by 21st January, 1972. Students re-enrolling in this way will normally be required to satisfy conditions pertaining to the course at the time of re-enrolment. This condition applies also to students who have been re-admitted to a course after exclusion under the rules restricting students re-enrolling.

ANNUAL EXAMINATIONS

Most annual examinations take place in November-December, although some are held in the mid-year recess. Timetables showing time and place at which individual examinations will be held are posted on the central notice boards, which are in the Bio-Medical Building, Central Lecture Block, Chancellery, Dalton Building, Main Building and Western Grounds area. Misreading of the timetable is not an acceptable excuse for failure to attend an examination. Examination results are posted to the term addresses of students. No results will be given by telephone.

All students will receive an enrolment details form by 30th August. It is not necessary to return this form, unless any information recorded there is incorrect. Amended forms must be returned to the Examinations Branch by 15th September. 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 $7 will be payable. Amended forms returned to the Registrar will be acknowledged in writing within fourteen days.

DEFERRED EXAMINATIONS

Deferred examinations may be granted in the following cases:

(i) 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.

Applications for deferred examination in this category must be lodged with the Registrar with appropriate evidence of the circumstances (e.g., medical certificate) not later than seven days after the examination concerned.

All such applications shall be reported to the Head of the School responsible for the subject. Before a deferred examination is granted on medical grounds, regard shall be paid to the student's class and assignment work in the subject, to his general performance in the year, and to the significance of the annual examination in compiling the composite mark.

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

(iii) To allow a student by further study to reach the required standard in a subject. The granting of a deferred examination in such cases will be based on the general quality of the student's performance.

(iv) Where a student's standing at the annual examinations is such that his progression or graduation could depend on his failure in one subject only, then his position in that subject shall be again reviewed with a view to determining whether a deferred examination may be granted notwithstanding his failure otherwise to qualify for such concession.

Deferred examinations must be taken at the centre in which the student is enrolled, unless he has been sent on compulsory industrial training to remote country centres or interstate. An application to take an examination away from the centre in which enrolled must be lodged with the Registrar immediately examination results are received. Normally, the student will be directed to the nearest University for the conduct of the deferred examination.

A student eligible to sit for a deferred examination must lodge with the Accountant an application accompanied by the fee of $7 per subject, by the date indicated on the notification of results.

APPLICATION FOR ADMISSION TO DEGREE

Applications for admission to a degree of the University must be made on the appropriate form by 15th January. Applicants should ensure that they have completed all requirements for the degree, including industrial training where necessary.

RESTRICTION UPON STUDENTS RE-ENROLLING

The University Council has adopted the following rules governing re-enrolment with the object of requiring students with a record of failure to show cause why they should be allowed to re-enrol and retain valuable class places. These rules will be applied retrospectively from January, 1971.

1. (i) A student shall show cause why he should be allowed to repeat a subject in which he has failed more than once. (Failure in a deferred examination as well as in the annual examination counts, for the purpose of this regulation, as one failure.) Where such subject is prescribed as a part of the student's course he shall be required to show cause why he should be allowed to continue the course.

Notwithstanding the provisions of Clause 1(i)

(ii) A student enrolled in the first year or first stage of any course, other than the medical course, who has failed in more than half the programme in which he is enrolled for that year or stage shall be required to show cause why he should be allowed to continue in the course.

(iii) A student enrolled in the first year of the Medical course who has failed in more than one subject of that year shall be required to show cause why he should be allowed to continue in the Medical course.

(iv) The provisions of sections (ii) and (iii) of this rule shall be deemed to apply to any student on transfer from another course or institution whose programme

of studies in the first year of enrolment immediately following transfer is comprised of subjects so chosen that half or more of such subjects are listed in the University Calendar as first year subjects.

2. Notwithstanding the provisions of clause 1, a student shall be required to show cause why he should be allowed to continue a course which he will not be able to complete in the time set down in the following schedule:

Number of years in course	Total time allowed from first enrolment to completion (years)
3	5
4	6
5	8
6	9
7	11
8	12

3. No full-time student shall, without showing cause, be permitted to continue a course unless all subjects of the first year of his course are completed by the end of his second year of attendance. No student in the Faculty of Arts shall, without showing cause, be permitted to continue a course unless he completes four subjects by the end of his second year of attendance. No full-time student in the Bachelor of Social Work course shall without showing cause be permitted to continue with the course unless he completes the equivalent of four full subjects by the end of his second year of attendance.

No part-time student shall, without showing cause, be permitted to continue a course unless all subjects of the first two stages of his course are completed by the end of his fourth year of attendance and all subjects of the third and fourth stages of his course by the end of his seventh year of attendance.

No student in the Faculty of Medicine shall, without showing cause, be permitted to continue with the medical course unless he completes the second year of the course by the end of his third year of attendance, and the third year of the course by the end of his fourth year of attendance.

4. A student who has a record of failure in a course at another University shall be required to show cause why he should be admitted to this University. A student admitted to a course at this

University following a record of failure at another University shall be required to show cause, notwithstanding any other provisions in these rules, why he should be permitted to continue in that course if he is unsuccessful in the annual examinations in his first year of attendance at this University.

5. Any student excluded under any of the clauses 1-3 may apply for re-admission after two academic years and such application shall be considered in the light of any evidence submitted by him.

6. A student wishing "to show cause" under these provisions shall do so in writing to the Registrar. Any such application shall be considered by a committee, hereinafter referred to as the Re-enrolment Committee, appointed by the Professorial Board, which shall determine whether the cause shown is adequate to justify his being permitted to continue his course or re-enrol as the case may be.

7. The Vice-Chancellor may on the recommendation of the Re-enrolment Committee exclude from attendance in a course or courses any student who has been excluded from attendance in any other course under the rules governing re-enrolment and whose record at the University demonstrates, in the opinion of the Re-enrolment Committee and the Vice-Chancellor, the student's lack of fitness to pursue the course nominated.

8. A student who has failed, under the provisions of Clause 6 of these rules, to show cause acceptable to the Re-enrolment Committee why he should be permitted to continue in his course, and who has subsequently been permitted to re-enrol in that course or to transfer to another course, shall also be required to show cause, notwithstanding any other provisions in these rules, why he should be permitted to continue in that course if he is unsuccessful in the annual examinations immediately following the first year of resumption or transfer of enrolment as the case may be.

9. Any student who is excluded from attendance in any course or subject under the provisions of these rules may appeal to an Appeal Committee constituted by Council for this purpose. The decision of the Appeal Committee shall be final.

10. The notification to any student of a decision by the Re-enrolment Committee to exclude the student from attendance in any course or subject shall indicate that the student may make

application for review of the decision to an Appeal Committee. In lodging such application the student shall ensure that a complete statement is furnished of all grounds on which the application is based and shall indicate whether or not the student wishes to appear in person before the Appeal Committee.

In considering an application for review the Committee of Review, on the basis of the student's academic record and the stated grounds for review, shall decide:

(i) whether there are grounds which justify the Committee seeing the student in person, or

(ii) whether there is sufficient information available to the Committee to allow decision without seeing the student in person

and so proceed to determine the application accordingly.

RE-ADMISSION AFTER EXCLUSION

Applications for re-admission must be made on the standard form and lodged with the Registrar not later than 30th June of the year prior to that for which re-admission is sought. An application should include evidence of appropriate study in the subjects (or equivalents) on account of which the applicant was excluded. In addition, 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, should be furnished. An applicant may be required to take the annual examinations in the relevant subjects as qualifying examinations in which case re-admission does not imply exemption from the subject.

Late applications cannot be considered where, in the opinion of the University, insufficient time will be available for the student to prepare himself for any qualifying examinations which may be required.

It should be noted that a person under exclusion may not be enrolled in miscellaneous subjects unless he has received the approval of the Admissions Committee of the Professorial Board.

Persons who intend applying for re-admission to the University at a future date may seek advice as to ways in which they may enhance their prospects of qualifying for re-admission. Enquiries should be made on a form obtainable from the Examinations Branch, and lodged with the Registrar.

OWNERSHIP OF STUDENTS' WORK

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

CHANGE OF ADDRESS

Students are requested to notify the Registrar in writing of any change in their address as soon as possible. Failure to do this could lead to important correspondence or course information not reaching the student. The University cannot accept responsibility if official communications fail to reach a student who has not notified the Registrar of a change of address.

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.

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.

PARKING WITHIN THE UNIVERSITY GROUNDS

Because of the limited amount of parking space available, only the following categories of students may apply for a permit: higher degree students (limited issue, annual fee $7.80); post-graduate, and senior undergraduate students who have completed three years of a full-time or part-time course. Permit will allow access to campus between 5 p.m. and 11 p.m. on weekdays and during library hours on Saturdays, Sundays and public holidays (annual fee $3.90). Applications should be made to the Property Section. It should be noted that increasing demand for parking space may require the imposition of further restrictions.

APPLICATION OF RULES

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.

Appeals

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

STUDENT SERVICES

THE LIBRARY

The University Library is on the upper campus and adjacent to the Chancellery and the Arts and Commerce buildings.

The Library's Undergraduate Collection covers the teaching and research interests of the Faculty, and students are expected to read widely and critically from it.

It is recommended that students attend the *"Introduction to the Library"* which is held at advertized times during Orientation Week and the first week of session 1. The *"Introduction"* uses audiovisual aids to describe the physical layout of the undergraduate library and the services available to readers. Copies of the booklet *Guide to the Library* are available on request. Students who are interested in a subject approach to information may attend a course which outlines methods of searching for information in libraries. This course runs for eight hours over a period of one week. Individual assistance for readers with specific library problems is provided by the *Reader Assistance Unit* which is located in the foyer.

The Bio-Medical Library is in the Biological Sciences building with a branch at Prince Henry Hospital ('phone 661-0111).

THE UNIVERSITY UNION

The University Union is a common meeting ground for all students. Restaurant and general recreational facilities are available, as well as stationery and hairdressing shops, a pharmacy, branches of several banks and a branch of David Jones'. Membership is compulsory for all registered students.

STUDENT ACCOMMODATION

Residential Colleges

Accommodation for 450 men and women students is provided within the complex of the Residential Colleges formed by Basser,

Goldstein and Philip Baxter Colleges. Tutors in residence provide tutorial assistance in a wide range of subjects. Board and residence fees amount to $308 per fourteen-week period. Intending students should apply in writing to the Master, Box 24, Post Office, Kensington, N.S.W., 2033.

New College (Church of England) and Warrane College (Catholic) are the first denominational colleges to be established on the campus. Each accommodates approximately 200 men students. Fees are $24.00 and $23.00 per week respectively. Enquiries should be made in each case to the Master.

Accommodation is also available at International House, which has a membership of 120. Approximately half this number is Australian, and the other half is drawn from a multiplicity of nationalities. Board and residence fees are $23.50. In selecting residents preference is given to postgraduate and more senior undergraduate students.

Other Accommodation

Students requiring other than Residential College accommodation may make personal application to the Housing Officer (Extn. 3260) at the Student Amenities Unit. Current lists are kept of accommodation available at recognized boarding houses, private homes, and in serviced and unserviced apartments.

STUDENT AMENITIES UNIT

The Amenities Service, working in close liaison with the Sports Association and the University authorities, assists various recognized clubs by arranging and providing facilities essential to their general development, and by handling on their behalf all inquiries and applications for membership.

Concession Fares

Application forms for travelling concessions may be obtained at the Inquiry Office, the Chancellery, Kensington, or at the Amenities Service Offices, Kensington.

Bus: Concessions are available to:

(a) Students under 18 years of age irrespective of whether they are employed or receive income or remuneration;

(b) full-time students including married women and clergymen, between 18 and 30 years of age who are not in employ-

ment or in receipt of any income or remuneration. In the case of married women students, the term 'income or remuneration' shall include the joint income or remuneration of the husband and wife.

NOTE. Income or remuneration includes allowances paid to Colombo Plan students, Public Service trainees, etc., but does not include allowances paid to holders of Commonwealth Scholarships, Teachers' College Scholarships or Scholarships granted by the State Bursary Endowment Board.

(c) alternatively, a $6.00 concession ticket may be purchased which allows a student to travel at reduced rates at any time from Monday to Friday and up to 6 p.m. on Saturdays between his home and the University. This concession applies only in the academic year and includes the May and August vacations.

Train:

(a) Periodical tickets are available during term time to full-time students not in employment or in receipt of any remuneration.

(b) Vacation travel concessions are available to students qualifying under (a) above.

(c) Country students may travel to and from their homes at weekends at concession rates, provided that both their home and term addresses have been registered with the University.

Ferry: Concession fares are available for travel on ferries controlled by the Port Jackson & Manly Steamship Co. Ltd. and Sydney Harbour Ferries Pty. Ltd. Applicants must be registered full-time students under the age of 21 years, and in the case of Sydney Harbour Ferries, under 20 years.

Aircraft: Concession fares for travel inter-state, intra-state and overseas are available under the conditions ruling for the various operating companies.

(i) *Inter-state* travel concessions are available only to *full-time* students under 26 years of age, not in receipt of remuneration. Eligible students must first purchase a 10-cent identity card and affix a passport-size photograph before being entitled to a reduction of 25% of adult fare.

(ii) *Intra-state*—Same conditions for travel concession apply on Airlines of New South Wales. East-West Airlines allows 33⅓% off normal adult fare to all *full-time* students during vacation periods.

(iii) *Overseas concessions* are available to students enrolling at the University or travelling to or from their homes to University, who are enrolled for at least one full year of studies.

Location:

The Student Amenities Unit at Kensington is located in Hut B at the foot of Basser Steps. (Tel. 663-0351, Ext. 2235.)

STUDENT EMPLOYMENT UNIT

Assistance is offered in finding employment over the long vacations giving course-related experience, or industrial training where this is a course requirement, casual employment and odd jobs, full-time employment for evening students, and permanent employment after graduation. The Service is located in the Chancellery on the ground floor.

CHAPLAINCY CENTRE

This Service is provided for the benefit of students and staff by five Christian Churches (Anglican, Roman Catholic, Methodist, Seventh Day Adventist, Churches of Christ) and by the Jewish congregation. Chaplains are in attendance at the University at regular times.

STUDENT HEALTH UNIT

Director: M. A. Napthali, MB, BS (*Syd.*)

A student health and first aid centre is situated within the University, staffed by two qualified medical practitioners, and a nursing sister.

The centre is located in hut "E" on the northern side of the campus, adjacent to Basser College. The service is available to all students, free of charge, between 9 a.m. and 5 p.m., Mondays to Fridays, and to part-time students, from 6 p.m. to 8 p.m., Tuesdays and Thursdays during University sessions by appointment.

The medical service is, in most instances, therapeutic, but is not intended to replace private or community health services. Thus, where chronic or continuing conditions are revealed or suspected, the student will be advised and referred to his own doctor or to an appropriate hospital for investigation and treatment. The health service is not responsible for fees incurred in these instances. The service is confidential and students are encouraged to attend the centre for advice on matters pertaining to health.

Appointments may be arranged by calling at the centre or by telephoning 663-0351, extension 2679 or 3275.

STUDENT COUNSELLING AND RESEARCH UNIT

The Student Counselling and Research Unit offers a free, confidential counselling service to help students, individually or in groups, to deal with problems, and to make plans and decisions associated with their personal, academic, and vocational progress.

Interviews, and group programmes, are available between 9 a.m. and 8 p.m. each week-day. Appointments may be made at the Unit, which is located at the foot of Basser Steps, or by ringing 663-0351, extensions 2600-2605 between 9 a.m. and 5 p.m.

FINANCIAL ASSISTANCE TO STUDENTS

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 progress with their studies.

Three forms of assistance are available. In the first, the University considers, in certain circumstances, deferment of the payment of fees; this scheme is not intended to replace the established procedure for granting deferment for short periods but rather to supplement it by making deferment over longer periods possible. Secondly, students in need may receive a cash loan not exceeding $300 from the Student Loan Fund established from contributions made by the Students' Union and the University. Thirdly, a Students' Union donation has made possible urgent cash loans not exceeding $100 for a period of one month.

In all cases assistance is limited to students with reasonable academic records and whose financial circumstances warrant loans. Students granted assistance of either kind are required

to give an undertaking to repay the loan under the conditions agreed upon.

Applications are made personally to the Deputy Registrar (Student Services).

UNIVERSITY CO-OPERATIVE BOOKSHOP LTD.

Membership is open to all students, on payment of a fee of $5, refundable when membership is terminated. Members receive an annual rebate on purchases of books.

UNDERGRADUATE SCHOLARSHIPS

Students undertaking courses in the Faculty of Applied Science are eligible to apply for the following scholarships.

Except where otherwise specified, applications on the form obtainable from the Admissions Office ('phone: 663-0351, ext. 2485) must be lodged with the Registrar, the University of New South Wales, P.O. Box 1, Kensington 2033, within seven days of the publication of the award of Commonwealth University Scholarships.

In addition to those scholarships made available by the University and other bodies as set out below, cadetships are offered by the Commonwealth Service, the New South Wales Public Service Board, the Department of Railways and a number of private industrial organizations. Cadets generally have their University fees paid by the employer, and are employed at cadet rates of pay during their course.

Commonwealth University Scholarships

There are three types, and all may be applied to full-time, part-time and external courses, and for pass and honours courses:— *Open Entrance Scholarships*, which are granted on the results of the Higher School Certificate Examination to students who are under thirty years of age on 1st January of the year in which they are first awarded the scholarship, and who with their parents are permanent residents of Australia; *Second or Later Year Scholarships*, which are awarded on the results obtained in approved university courses, are available to students who have completed the equivalent of one year of a full-time course (age and residential qualifications are the same as for Open Entrance); and *Mature Age Scholarships*, which are available to students who are over thirty on 1st January of the year in which they are first awarded a scholarship. Applicants should be permanent residents of Australia.

Benefits include payment of all tuition fees and other compulsory fees and living allowances (these latter being subject to a means test) up to $700 per annum or $1,100 per annum if living

away from home. The closing date for applications is 30th September in the year immediately preceding that for which the scholarship is desired. Full particulars and application forms may be obtained from the Department of Education and Science, 70 Castlereagh Street, Sydney, 2000, or Box 3987, G.P.O. Sydney, 2001 (Telephone: 2-0323).

University Scholarships

The University annually awards up to fifteen scholarships to students who have matriculated at the Higher School Certificate Examination; ten scholarships to students who have completed certificate courses (Department of Technical Education); ten scholarships to students who have completed Trade Courses (Department of Technical Education) and ten scholarships to part-time students who have taken the Diploma Entrance course of the Department of Technical Education. The scholarships exempt the holder from payment of course fees during the currency of the scholarship. Scholarships will be awarded in order of merit on Higher School Certificate Examination results. They may be held only by persons who do not hold another award and whose parents are permanent residents of Australia. Applications for these scholarships, on forms obtainable from the Registrar, must be lodged with the Registrar within seven days of the publication of the award of Commonwealth University Scholarships.

Bursaries

Numbers of Bursaries tenable at the University are awarded to candidates of merit at the Higher School Certificate Examination whose family income falls within certain limits prescribed by the Bursary Endowment Board. Applications should be made to the Secretary, Bursary Endowment Board, P.O. Box R42 Royal Exchange, N.S.W. 2000.

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 Kensington College Ltd. The annual value of the Scholarship is $100. It may be held concurrently with Commonwealth and 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 College Ltd., Box 24, P.O., Kensington, 2033.

Australian Coal Association

The Association offers scholarships for students wishing to undertake degree courses in Mining Engineering or Applied Geology. The scholarships are valued at $600 to $900 p.a., plus $200 living-away-from-home allowance where applicable, fees and a book allowance of $100 p.a. Further details may be obtained from Australian Coal Industry Research Laboratories Ltd., P.O. Box 169, Chatswood, N.S.W.

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. Preference is given to Commonwealth Scholarship holders. 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 one scholarship annually for students wishing to undertake a degree course in Mining Engineering, Metallurgy or Geology. The value of the scholarship is $800 p.a., plus $300 living-away-from-home allowance where applicable and paid vacation work, and is tenable for the duration of the course. 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. The value of these scholarships ranges from $700 to $1,100 per annum (including allowance for books and instruments). These scholarships will be awarded on the understanding that applicants will normally hold a Commonwealth University Scholarship which covers the cost of University fees. However, applicants without Commonwealth University Scholarships may be given consideration. While scholarship holders are not under bond it is expected that they will obtain employment in Coal Mining or a related industry on graduation. Applications on forms obtainable from headmasters or from the Secretary, Joint Coal Board, Box 3842, G.P.O., Sydney, must be lodged with the Board's Secretary not later than seven days after the publication of the award of Commonwealth University Scholarships.

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 scholarships which are valued at $250-$1,200 p.a., are tenable until the course has been completed. 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. The scholarships have a value of $700 per annum and are tenable for four years. 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. The scholarships are tenable for four years and are valued at $980 p.a. for adults and from $650 to $980 p.a. for juniors, plus University fees and allowances. 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 scholarships are valued at $800 p.a., plus tuition fees, and are tenable for the duration of the course. 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. The scholarship is tenable for the duration of the course and is valued at $800 p.a. with annual increments of $100. Where a Commonwealth Scholarship is not held full University fees will be paid. Applications to The Manager, Territory Enterprises Pty. Ltd., P.O. Box 368, Darwin, N.T., 5794.

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 B.Sc. 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 a Commonwealth Scholarship.

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 scholar-

ship 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. Applicants are expected to apply for a Commonwealth Scholarship to cover course and other University fees.

University of New South Wales Chemical Engineering Association Scholarships

The Association offers two scholarships, 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 Chemical Engineering course or have satisfactorily completed Year 1 of the course or some programme of equivalent academic standard. The scholarships have a value of $200 p.a. and are normally tenable for four years. Applicants are expected to apply for a Commonwealth Scholarship to cover course and other University fees.

Western Mining Corporation Ltd.

The company offers annually a scholarship to the value of $1,000 to students undertaking the degree course in Chemical Engineering, Metallurgy or Mining Engineering.

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 a Commonwealth Scholarship.

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 and holders of Commonwealth Scholarships may apply. 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, 1972.

James Howden Scholarship in Fuel Engineering

James Howden & Co. provide one scholarship in Fuel Engineering with a value of $300 per annum. This is normally tenable for one year but may be extended subject to satisfactory progress in the course and availability of funds.

John Strevens' Fuel Engineering Scholarship

Mr. John Strevens offers a scholarship to the value of $300, on the basis of academic merit and personality, for students who are British subjects and have met University requirements for admission to any year of the full-time BE course in Fuel Engineering (with Fuel Engineering electives). The scholarship is normally tenable for one year, but application for extensions will be considered subject to satisfactory progress in the course and the 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.

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

The Commonwealth Industrial Gases Ltd. may provide annually a scholarship tenable at the University of New South Wales for students wishing to enrol in the full-time course for the B.Sc. degree in Metallurgy. If awarded, the scholarship will be tenable for a maximum of four years, and will have a value of $500 per annum payable in fortnightly instalments as a living allowance. Applicants are expected to apply for a Commonwealth Scholarship to cover course and other University fees.

Conzinc Riotinto of Australia Ltd.

The Company offers each year two scholarships for students wishing to qualify for the degree of Bachelor of Science in Metallurgy or Bachelor of Engineering in Mining Engineering. Applicants may be students who have completed one or more years of an approved course. The value of each scholarship is $700 per annum, or $1,000 per annum if the student is living away from home, plus a book allowance of $100. It is expected that applicants will hold Commonwealth Scholarships, which will cover the cost of fees.

Electricity Commission of New South Wales

The Commission offers scholarships to students wishing to undertake degree courses in Metallurgy or Industrial Chemistry. The scholarships are valued at $1,608 in First Year rising to $2,560 in Fourth Year, plus fees and vacation training. Further details may be obtained from the Electricity Commission of N.S.W., 1 Castlereagh Street, Sydney, 2000.

Metal Manufactures Clement Blazey Memorial Scholarship in Metallurgy

Metal Manufactures Ltd. of Port Kembla provide the Clement Blazey Memorial Scholarship for students enrolling in the full-time course in Metallurgy leading to the Degree of Bachelor of Science. The scholarship is available in alternate years (next available in 1972), and has a value of between $200 and $800 per annum payable to students as a living allowance and will normally be tenable for four years. It may be held concurrently with a Commonwealth Scholarship.

School of Metallurgy Scholarship

Staff members of the School of Metallurgy have undertaken to provide a scholarship for students wishing to enrol in Year 1 of the full-time course (Pass or Honours) in Metallurgy. The value of the scholarship is $500 per annum, and 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 to 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 scholarship has a value of $200 per annum and is tenable for one year.

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., Prince-Smith and Stells Ltd., Universal Textiles (Aust.) Ltd. Each scholarship has a value of $1,000 per annum and may be held concurrently with a Commonwealth Scholarship. An applicant for this scholarship will also receive consideration for the Wool Research Trust Fund Scholarships in Textile Technology.

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. The Scholarships now current have been made available by William Cooper & Nephews (Aust.) Pty. Ltd., Merck Sharp & Dohme (Aust.) Pty. Ltd., the Commercial Banking Company of Sydney Ltd. and the National Council of Wool Selling Brokers of Australia, The Australian Estates Co. Ltd., Australian Wool Board, and others. Valued at $1,000 per annum, these scholarships are normally tenable for four years, and may be held concurrently with a Commonwealth Scholarship. An applicant for these scholarships will also receive consideration for the Wool Research Trust Fund Scholarships in Wool and Pastoral Sciences.

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

A number of scholarships for courses in Wool and Pastoral Sciences and 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, and successful applicants may hold a Commonwealth Scholarship concurrently.

FACULTY REGULATIONS

RULES OF PROGRESSION

Progression in Full-Time Courses Where Progression is by the Year

1. No full-time student (except those in the Science course, or in Arts, Commerce or Engineering) will be permitted to attend lectures or sit for examination in any subject in any year until he has passed in all subjects of the previous year, unless special permission has been granted by the faculty in which he is enrolled.

2. A student who fails to qualify to progress to the next year of the course where progression is by years may be granted, by the Head of the School conducting the course, exemption from further attendance and examination in any subject in which he has achieved a pass at a satisfactory standard. Such student may repeat those subjects required to complete the year by attendance at either day or evening classes.

3. Any student who elects to transfer to the related part-time course is not eligible to be considered for additional deferred examinations at the time of transfer and may not qualify for progression to the next year of the full-time course merely by completing the part-time equivalents of the subjects in which he has failed.

4. In general, students who fail in full-time courses, and who transfer to part-time courses, shall not be re-admitted with standing to the full-time course until they have graduated from the part-time course.

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 degrees of Bachelor of Science and Bachelor of Engineering. The Schools of Chemical Engineering, Chemical Technology, Metallurgy, and Mining Engineering (at Wollongong and Broken Hill), offer part-time courses leading to the degree of Bachelor of Science (Technology) and 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 requiring 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 thirty-six weeks' approved practical work. In Mining Engineering students will undertake a programme of practical training of at least 100 days.

Part-Time Courses

The Schools of Chemical Engineering, Chemical Technology, Metallurgy and Mining Engineering offer six-year part-time courses leading to the degree of Bachelor of Science (Technology) in Chemical Engineering, Food Technology, Industrial Chemistry, Ceramics, Metallurgy, and Mining Engineering (Wollongong). At Broken Hill a part-time course in Mining Engineering leads to the degree of Bachelor of Science (Engineering) and a part-time course in Mineral Processing to the degree of Bachelor of Science (Technology).

Students who qualify for the B.Sc(Tech.) degree in the Faculty of Applied Science and who wish to proceed to a B.Sc. or B.E. 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

All undergraduates in Faculties other than Arts and Law are required to complete a General Studies programme. In this way the University hopes to give its students a general understanding of the different aspects of the world in which they live. The Department of General Studies publishes its own handbook which is available free of charge. All details regarding general studies courses and requirements are contained in it, and students are advised to obtain a copy.

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 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 available to students in the Faculty of Science. Selected students in the Faculty of Science may also read for an honours degree in Geology.

In order to meet the demands for trained Geophysicists in the Commonwealth a Graduate Diploma course in Applied Geophysics is offered.

A Master of Applied Science course in Hydrogeology has also been instituted to train people to deal with the problems of underground water supply.

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 / 1.031	Physics I *or* / Physics IAS	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
1.112	Physics II (units A and C) *or*	2	—	5	3
1.212	Physics IIT (units B and C)	1½	1½	1½	1½
2.022	Chemistry II (M)	3	2½	3	2½
	General Studies Elective	1	½	1	½
plus *one* of the following:					
5.001	Engineering I *or*	3	3	3	3
10.111	Pure Mathematics II (units A and B)‡ *or*	4	—	4	—
10.211	Applied Mathematics II (units A and (B or C))‡ *or*	2/6	0	6/2	—
17.001	General and Human Biology *or*	3	3	3	3
27.001	Applied Geography I	2	4	2	4

* Univ. of Tas. Summer School course, Geology I, is accepted as entrance qualification for Year II of Applied Geology in case of students who have not previously attempted Geology I at this University.

† 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.

YEAR 3		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
25.003/1 25.003/2	Geology III, Part 1* Geology III, Part 2	7	6	7	5
25.013	Geology IIIS†	7	4	5	6
	Two General Studies Electives	2	1	2	1
		16	11	14	12

* Field work is an essential part of the course. It includes ten days' geological survey camp, which will be held before the beginning of Session 1, and a further ten days on a field tutorial. Attendance is compulsory.

† Includes a ten-day field tutorial. Attendance is compulsory.

YEAR 4†					
7.551	Mining and Mineral Process Engineering	2	2	0	0
8.241	Geomechanics	2	3	0	0
25.004/1	Geology IV, Part 1*	2	1	0	0
25.004/2	Geology IV, Part 2*	2	2	0	0
25.004/3	Geology IV, Part 3*	3	1	0	0
25.004/4	Geology IV, Part 4*	1½	2	0	0
25.004/5	Geology IV, Part 5*	0	0	0	30
	General Studies Advanced Elective	1	½	1	½
		13½	11½	1	30½

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

* Four short visits to civil engineering works and mine workings are included in the course.

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 utilisation 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 technologists are concerned with the management of foods from the time of production until they reach the consumer. It is their responsibility 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

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 B.E. 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.
1.031	Physics IAS	3	3	3	3
2.001	Chemistry I	2	4	2	4
5.001	Engineering I	3	3	3	3
10.001 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	2
		12	12	12	12
YEAR 2					
2.002	Chemistry IIS	5	3	3	7
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	1	1	1	1
	Two General Studies Electives	2	1	2	1
		13	10	10	16

		Hours per week			
		SESSION 1		SESSION 2	
			Lab.		Lab.
YEAR 2 (Cont.)		Lec.	Tut.	Lec.	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	4	7	0	3
3.122	Chemical Engineering Thermodynamics and Reaction Engineering	2	1	2	1
3.123	Chemical Engineering Design I A and B	1½	1½	5½	5½
3.124	Chemical Engineering Design and Practice*				
6.801A	Circuit Theory and Electronics	1	2	0	0
6.801B	Electrical Machines	0	0	1	2
10.032	Mathematics	1	1	1	1
	General Studies Elective	1	½	1	½
		10½	13	10½	13
	Plus *one* of the following electives:				
2.221	Chemistry and Enzymology of Foods	1	3	1	3
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
22.112	Industrial Chemistry II (Chemical Processes)†	1½	0	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		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
3.131	Chemical Engineering Principles III	2	0	2	0
3.132	Chemical Engineering Process Dynamics and Control	1	4	1	4
3.133	Chemical Engineering Design II	2	6	0	0
	General Studies Elective	1	½	1	½
	Project*	0	2	0	10
		6	12½	4	14½
	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	7	0	7	0
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
7.311	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.†				

*One 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

† Students taking Year 2 or Year 3 electives at this point may prejudice their honours degree.

Chemical Engineering—Part-Time Course
Bachelor of Science (Technology)

This course, which extends over six years of part-time study, covers approximately the same subject matter as the first three

years of the full-time course, and is designed to meet the requirements of students who are employed in the chemical processing industries.†

Students who have completed the requirements of this course qualify for the degree of Bachelor of Science (Technology) and may proceed to the degree of Bachelor of Engineering by attending for one full-time year and completing the subjects listed in the fourth year of the full-time course. Students desiring to proceed to a Bachelor of Engineering degree must apply to the Head of the School not later than December 31 of the year in which the sixth stage is completed.

The B.Sc. (Tech.) degree is recognized by the Institution of Engineers, Australia, and the Royal Australian Chemical Institute, as sufficient qualification, and by the Institution of Chemical Engineers, U.K., as partial qualification, for corporate membership.

		Hours per week			
		SESSION 1		SESSION 2	
STAGES 1 and 2*		Lec.	Lab. Tut.	Lec.	Lab. Tut.
1.031	Physics IAS	3	3	3	3
2.001	Chemistry I	2	4	2	4
5.001	Engineering I	3	3	3	3
10.001	Mathematics I *or*				
10.011	Higher Mathematics I‡	4	2	4	2
		12	12	12	12
STAGE 3					
2.002	Chemistry IIS	5	3	3	7
10.031	Mathematics	1	1	1	1
	Two General Studies Electives	2	1	2	1
		8	5	6	9
STAGE 4					
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
10.331	Statistics	1	1	1	1
		5	5	4	7

† See below for outline of this course involving combined full-time and part-time study.
* Two of the subjects listed will be taken in the first year and the other two in second year (as directed).
‡ There will be no evening lectures in this subject in 1972.

		Hours per week			
		SESSION 1		SESSION 2	
		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
STAGE 5					
3.122	Chemical Engineering Thermodynamics and Reaction Engineering	2	1	2	1
3.123/1	Chemical Engineering Design IA	1½	1½	1½	1½
6.801A	Circuit Theory and Electronics	2	1	0	0
6.801B	Electrical Machines	0	0	2	1
10.032	Mathematics	1	1	1	1
		6½	4½	6½	4½
	Plus *one* of the following Electives:				
2.221	Chemistry and Enzymology of foods	1	3	1	3
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
22.112	Industrial Chemistry II (Chemical Processes)*	1½	0	1½	2½
	Any Year 2 Elective not previously studied.				

* Less factory visits. These are part of 3.123 Chemical Engineering Design 1A and B.

STAGE 6					
3.121	Chemical Engineering Principles II	4	7	0	3
3.123/2	Chemical Engineering Design IB	0	0	4	4
3.124*	Chemical Engineering Design and Practice				
	General Studies Elective	1	½	1	½
		5	7½	5	7½

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

Chemical Engineering BcSc. (Tech.) in Full-Time—Part-Time Study

Students enrolling in the Chemical Engineering, B.Sc.(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 B.Sc.(Tech.) course above)
Stage 2.....Part-time (as for B.Sc.(Tech.) course above)
Stage 3A.....Full-time (as for second year of full-time B.E. course above)
Stage 4A.....Full-time (as for third year of full-time B.E. course above)
Stage 5A.....Part-time (as set out below)

STAGE 5A*

A programme of 6-9 hours per week selected from the following subjects on the advice of the Head of the School of Chemical Engineering:

3.321 Fuel Engineering II
4.011 Metallurgy I
7.311 Mineral Processing I
22.112 Industrial Chemistry II
22.211 Ceramics I
22.311 Polymer Science I
44.111 Microbiology
Any other subject approved by the Professorial Board on the recommendation of the Head of School or Department.

* This course is subject to revision.

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.

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 2.221 Chemistry and Enzymology of Foods; and in Year 4 3.411 Biological Process Engineering.

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 and Environmental Pollution Control. Opportunities for postgraduate studies and research for higher degrees in these areas are particularly good.

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 B.E. 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.

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 B.E. 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 or 3.332 Fuel Engineering IV or 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 technologists are concerned with the storage, processing, preservation, packaging and distribution of foods. Food technology—a branch of applied science—covers the management of fresh foods of all kinds, the canning, freezing, refrigeration, and dehydration of foods, the development of new foods from conventional and unconventional sources, and the utilization of the by-products of the food industries.

The food scientist acquires new knowledge by laboratory experiments. The food technologist applies such knowledge to practice in manufacture and commerce. He must, therefore, be entirely familiar with food science in its many facets.

Food technology is a profession equally suitable to men and women, and offers much in reward to the adequately trained person prepared to accept responsibility as the guardian of the quality and safety of man's food supplies.

There is great need for food technologists to help solve the prime problem of our age—to make food supplies increase faster than the world's population, to let nothing perish that could serve as food for man or beast.

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 and the Australian Institute of Food Science and Technology.

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.

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.

Years 2, 3 and 4 of the course have been revised. Full-time students who completed Years 2 or 3 in 1971 will continue with the course programme appearing in the 1971 Calendar and Handbook.

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 1		Lec.	Lab. Tut.	Lec.	Lab. Tut.
1.031	Physics IAS	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
17.001	General and Human Biology	2	4	2	4
		11	13	11	13
YEAR 2					
2.002	Chemistry II	5	3	3	7
3.201	Food Technology I	0	0	2	4
10.031	Mathematics	1	1	1	1
41.101	Biochemistry I, (Units A and B)	4	8	0	0
44.101	Introductory Microbiology	1	2	1	2
	General Studies Elective	1	½	1	½
		12	14½	8	14½

YEAR 3					
2.261	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	1	1	1	1
44.102B	Basic General Microbiology—Microbial Physiology and Ecology	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
		4	12½	4	12½
	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
28.104	Marketing Models and Systems	4	0	4	0
41.102A	Biological Macromolecules and Cell Biochemistry	3	9	0	0
41.102B	Metabolic Pathways and Control Mechanisms	0	0	3	9
42.102	Fermentation Technology	0	0	2	4
44.102A	Basic General Microbiology .... Nature of Microorganisms	0	0	2	4
44.102D	General Applied Microbiology —or such other electives, to a total of not less than 6 hrs/week, as approved by the Head of School	0	0	2	4

During the 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.

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 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 B.Sc. degree must apply to the Head of the School not later than December 31 of the year in which the sixth stage is completed.

Stages 4, 5 and 6 of the course have been revised. Part-time students who completed Stages 4 or 5 in 1971 will continue with the course programme appearing in the 1971 Calendar and Handbook.

		Hours per week			
		SESSION 1		SESSION 2	
STAGES 1 and 2*		Lec.	Lab. Tut.	Lec.	Lab. Tut.
1.031	Physics IAS	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†				
17.001	General and Human Biology	2	4	2	4
		11	13	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 in 1972.

STAGE 3					
2.002	Chemistry IIS	5	3	3	7
10.031	Mathematics	1	1	1	1
44.101	Introductory Microbiology	1	2	1	2
		7	6	5	10

		Hours per week			
		SESSION 1		SESSION 2	
			Lab.		Lab.
STAGE 4		Lec.	Tut.	Lec.	Tut.
3.201	Food Technology I	0	0	2	4
41.101	Biochemistry I, (Units A and B)	4	8	0	0
	Two General Studies Electives	2	1	2	1
		6	9	4	5
STAGE 5					
2.261	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	1	1	1	1
44.102B	Basic General Microbiology—Microbial Physiology and Ecology	2	4	0	0
	General Studies Elective	1	½	1	½
		6	5½	4	9½

Food Technology B.Sc. (Tech.) in Full-Time/Part-Time Study

Students enrolling in the Food Technology B.Sc. (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 B.Sc.(Tech.) course above)
Stage 2.....Part-time (as for B.Sc.(Tech.) course above)
Stage 3A.....Full-time (as for second year of full-time B.Sc. course above)
Stage 4A.....Full-time (as for third year of full-time B.Sc. course above)
Stage 5A.....Part-time

STAGE 5A

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 Wollongong University College 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 Wollongong University College 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.

Industrial Chemistry—Full-Time Course
Bachelor of Science

YEAR 1		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.031	Physics IAS	3	3
2.001	Chemistry I	2	4
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2
Plus one of:—			
5.001	Engineering I	3	3
17.001	General and Human Biology	2	4
25.111	Geoscience I*	2	4

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

YEAR 2			
1.212	Physics IIT (Unit B)*	1½	1½
2.311	Physical Chemistry	1½	3
2.411	Inorganic Chemistry	1	2
2.611	Organic Chemistry	1½	3
10.031	Mathematics	1	1
10.331	Statistics	1	1
22.111	Industrial Chemistry I	2	2
	General Studies Elective	1	½
		10½	14

* 14 weeks' course.

YEAR 3*		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.211	Applied Organic Chemistry	1	3	1	3
3.111	Chemical Engineering Principles I	2	0	1	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	0	0
3.311	Fuel Engineering I	1½	½	1½	½
22.112	Industrial Chemistry II	6	5	6	5
	Two General Studies Electives	2	1	2	1
		13½	11½	11½	11½

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

Options: With the approval of the Head of School, students may substitute 22.311 Polymer Science I (4-4; 2-4) for 3.112 Chemical Engineering Material Balances and Thermodynamics, 3.311 Fuel Engineering I and the Inorganic Industrial Chemistry lectures and the laboratory sections of 22.112 Industrial Chemistry II.

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 4		Lec.	Lab. Tut.	Lec.	Lab. Tut.
22.113	Industrial Chemistry III	8	5	3	1
22.121	Industrial Chemistry Seminar	0	2	0	2
22.191	Project	0	7	0	16
	General Studies Advanced Elective*	2	0	2	0
		10	14	5	19

Option: With the approval of the Head of School, students may substitute 22.312 Polymer Science II for Section (a) Processes in 22.113 Industrial Chemistry III.

* 18 weeks' course, terminating before recess in Session 2.

Industrial Chemistry—Part-Time Course
Bachelor of Science (Technology)

		Hours per week for 2 Sessions	
STAGES 1 and 2*		Lec.	Lab. Tut.
1.031	Physics IAS	3	3
2.001	Chemistry I	2	4
10.001 10.011	Mathematics I *or* Higher Mathematics I†	4	2
Plus *one* of:—			
5.001	Engineering I	3	3
17.001	General and Human 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 in 1972.

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

STAGE 3		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.212	Physics IIT (Unit B)*	1½	1½
2.611	Organic Chemistry I	1½	3
10.031	Mathematics	1	1
10.331	Statistics	1	1
	General Studies Elective	1	½
		6	7

* 14 weeks' course.

STAGE 4		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.311	Physical Chemistry	1½	3	1½	3
2.411	Inorganic Chemistry	1	2	1	2
22.111	Industrial Chemistry I	2	2	2	2
	General Studies Elective	1	½	1	½
		5½	7½	5½	7½

STAGE 5					
3.111	Chemical Engineering Principles I	2	0	1	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	0	0
3.311	Fuel Engineering I	1½	½	1½	½
22.112/1	Industrial Chemistry II, Part I	1½	2½	1½	2½
		6	5	4	5

Option: With the approval of Head of School, students may substitute 22.311 Polymer Science I (4-4; 2-4) for 3.112 Chemical Engineering Material Balances and Thermodynamics, 3.311 Fuel Engineering I and the Inorganic Industrial Chemistry lectures and the laboratory sections of 22.112/1 Industrial Chemistry II, Part I.

STAGE 6		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.211	Applied Organic Chemistry	1	3	1	3
22.112/2	Industrial Chemistry II, Part II	4½	2½	4½	2½
	General Studies Elective	1	½	1	½
		6½	6	6½	6

Ceramic Engineering—Full-Time Course
Bachelor of Science

YEAR 1					
1.031	Physics IAS	3	3	3	3
2.001	Chemistry I	2	4	2	4
5.001	Engineering I	3	3	3	3
10.001 10.011	Mathematics I *or* Higher Mathematics I }	4	2	4	2
		12	12	12	12

YEAR 2		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.212	Physics IIT (Units B and C)	1½	1½
2.311	Physical Chemistry	1½	3
2.411	Inorganic Chemistry	1	2
2.511	Analytical Chemistry	1	3
8.112	Materials and Structures	1	2
10.031	Mathematics	1	1
10.331	Statistics	1	1
	General Studies Elective	1	½
		9	14

YEAR 3*		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
3.111	Chemical Engineering Principles I	2	0	1	2
3.112	Chemical Engineering Material Balances and Thermodynamics*	1	2	0	0
3.311	Fuel Engineering I	1½	½	1½	½
22.211	Ceramics I	4	5	4	5
22.221	Chemical Thermodynamics and Kinetics	1½	1½	1½	1½
25.201	Mineralogy	1	1	1	2
	Two General Studies Electives	2	1	2	1
		13	11	11	12

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

YEAR 4					
22.212	Ceramics II	3	3	3	3
22.231	Ceramic Engineering	2	2	2	2
22.241	Instrumentation Process Control	4	4	0	0
22.251	Operation Research and Seminars	2	0	0	0
22.291	Project	0	4	0	11
	General Studies Advanced Elective*	2	0	2	0
		11	13	7	16

* 18 weeks' course, terminating before recess in Session 2.

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

STAGES 1 and 2*		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.031	Physics IAS	3	3
2.001	Chemistry I	2	4
5.001	Engineering I	3	3
10.001 10.011	Mathematics I *or* Higher Mathematics I†	4	2
		12	12

* Two subjects will be taken in the first year and the other two in the second year (as directed).
† There will be no evening lectures in this subject in 1972.

		Hours per week for 2 Sessions	
STAGE 3		Lec.	Lab. Tut.
1.212	Physics IIT (Units B and C)	1½	1½
2.311	Physical Chemistry	1½	3
10.031	Mathematics	1	1
10.331	Statistics	1	1
		5	6½

STAGE 4			
2.411	Inorganic Chemistry	1	2
2.511	Analytical Chemistry	1	3
8.112	Materials and Structures	1	2
	General Studies Elective	1	½
		4	7½

STAGE 5			
22.211/1	Ceramics I (Part I)	2	2
22.221	Chemical Thermodynamics and Kinetics	1½	1½
25.201	Mineralogy	1	1
	General Studies Elective	1	½
		5½	5

		Hours per week			
		SESSION 1		SESSION 2	
STAGE 6		Lec.	Lab. Tut.	Lec.	Lab. Tut.
3.111	Chemical Engineering Principles I	2	0	1	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	0	0
3.311	Fuel Engineering I	1½	½	1½	½
22.211/2	Ceramics I (Part II)	2	3	2	3
	General Studies Elective	1	½	1	½
		7½	6	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. These four-year full-time undergraduate courses aim to train professional geographers for entry into applied fields, with elective specialisation in biogeography, economic geography with emphasis on urban geography, or geomorphology and pedology. The physical basis of geography is studied systematically in the first year, while in the second year there is similar treatment of economic and social geography with additional consideration of geographic methods in general. There is progressive specialisation 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 cetra.*

Applied Geography—Full-Time Course

Bachelor of Science

BIOGEOGRAPHY

		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
17.001	General and Human Biology	3	3	3	3
27.001	Applied Geography I*	2	4	2	4
		11	13	11	13

* Up to 3 days' field tutorials are an essential part of the course.

YEAR 2					
1.031	Physics IAS	3	3	3	3
27.002	Applied Geography II*	2	4	2	4
43.101A	Genetics and Biometry	3	3	0	0
43.101B	Plant Evolution and Ecology	0	0	2	4
	General Studies Elective	1	½	1	½
		9	10½	8	11½

* Up to 5 days' field tutorials are an essential part of the course.

YEAR 3*					
27.013	Geographic Methods	0	1½	0	1½
27.103	Climatology	0	0	2	3½
27.203	Biogeography	2	3½	0	0
27.403	Geomorphology and Pedology	2	3½	2	3½
43.102E	Environmental Botany	2	4	0	0
43.101C	Plant Physiology	0	0	2	4
45.101D	Field Ecology†	0	0	1	0
	Two General Studies Electives	2	1	2	1
		8	13½	9	13½

* A four-day field tutorial prior to the beginning of Session 1, and up to seven days' field tutorials later in the year are essential parts of the third-year programme.

† This subject includes a two-week field tutorial at the end of Session 2.

YEAR 4		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
27.204	Advanced Biogeography	3	6	0	0
27.333	Agricultural Geography*	2	3½	0	0
27.504	Project (Biogeography)	0	2	0	10
	General Studies Advanced Elective	1	½	1	½
		6	12	1	10½

* A one-day field tutorial is an essential part of the course.

GEOMORPHOLOGY AND PEDOLOGY

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
17.001	General and Human Biology	3	3
27.001	Applied Geography I*	2	4
		11	13

* Up to 3 days' field tutorials are an essential part of the course.

YEAR 2			
1.031	Physics IAS	3	3
25.111	Geoscience I	3	3
27.002	Applied Geography II*	2	4
	General Studies Elective	1	½
		9	10½

* Up to 5 days' field tutorials are included in these subjects.

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 3*		Lec.	Lab. Tut.	Lec.	Lab. Tut.
25.112	Geoscience II	5	4	4	5
27.013	Geographic Methods	0	1½	0	1½
27.103	Climatology	0	0	2	3½
27.203	Biogeography	2	3½	0	0
27.403	Geomorphology and Pedology	2	3½	2	3½
	Two General Studies Electives	2	1	2	1
		11	13½	10	14½

* A four-day field tutorial prior to the beginning of Session 1, and up to 7 days' field tutorials later in the year are essential parts of the third year programme.

YEAR 4					
8.245	Soil Mechanics	1	1	1	1
25.013	Geology III (Supplementary)*	2	2	2	2
27.404	Advanced Geomorphology and Pedology	3	6	0	0
27.504	Project (Geomorphology and Pedology)	0	2	0	10
	General Studies Advanced Elective	1	½	1	½
		7	11½	4	13½

* Selected strands in Geochemistry, Sedimentary Petrology and Clay Mineralogy.

ECONOMIC GEOGRAPHY

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
15.101	Economics I	2	1
53.121	Sociology IT	2	2
27.001	Applied Geography I*	2	4
		10	9

* Up to 3 days' field tutorials are an essential part of the course.

YEAR 2		Hours per week for 2 Sessions Lec.	Lab. Tut.
15.102	Economics II	2	2
27.002	Applied Geography II*	2	4
28.104	Marketing Models and Systems	4	0
		8	6

* Up to 5 days' field tutorials are an essential part of the course.

YEAR 3		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
15.103	Economics III	1	1	1	1
15.243 / 15.263	Economic Development *or* International Economics	1	1	1	1
15.402	Econometric Methods	2	1	2	1
27.303	Transportation Geography*	0	0	2	3½
27.313	Location Theory*	2	3½	0	0
27.323	Marketing Geography*	0	0	2	3½
27.333	Agricultural Geography*	2	3½	0	0
27.013	Geographic Methods	0	1½	0	1½
		8	11½	8	11½

* Students will attend a weekly seminar at Honours level in two of these subjects. Up to 5 days' field tutorials are an essential part of the course.

YEAR 4					
36.411	Town Planning	2	1	0	0
27.304	Advanced Economic Geography	2	3	0	1
27.504	Project (Economic Geography)	0	3	0	10
12.001	Psychology I *or*	3	2	3	2
51.111	History I *or*	2	1	2	1
53.121	Sociology IT* *or*	2	2	2	2
54.111	Political Science I	2½	2	2½	2

* Students enrolled in 1970.

GEOGRAPHY IN OTHER FACULTIES

Courses in Geography are available on a full-time basis in other Faculties as follows:—

Arts and Commerce	—	27.041 Geography IA
		27.042 Geography IIA
		27.052 Geography IIA (Honours)
		27.043 Geography IIIA
		27.053 Geography IIIA (Honours)
		27.063 Geography IIIB
		27.073 Geography IIIB (Honours)
Arts	—	27.054 Geography IVA (Honours)
Science	—	27.031 Geography IS

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, Port Pirie, Whyalla, Kwinana, Gladstone 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 first year of the full-time Metallurgy course consists of physics, chemistry, mathematics, and *either* engineering *or* geology. The structure of this first year 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 first year.

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.

While the emphasis in the course is on providing a broad fundamental background in all branches of metallurgy, provision is made for a limited amount of specialization of the student's own choice in the final year.

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.

		Hours per week for 2 Sessions	
		Lec.	Lab. Tut.
YEAR 1			
1.031	Physics IAS	3	3
2.001	Chemistry I	2	4
10.001 10.011	Mathematics I *or* Higher Mathematics I	4	2
Plus one of			
5.001	Engineering I	3	3
25.111	Geoscience I	2	4

YEAR 2		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.022	Chemistry II (M)	3	4	3	3
4.011	Metallurgy I	5	6	5	6
4.031	Physics of Metals*	1	3	1	0
10.031	Mathematics	1	1	1	1
5.001	Engineering I, Part A *or*	2	0	2	0
25.201	Mineralogy	1	1	1	1
	General Studies Elective	1	½	1	½
		12/13	14½/15½	11/12	10½/11½
*From Week 12 in Session 1		1	0		

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			
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.

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.

‡ See below for outline of this course involving combined full-time and part-time study.

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.

STAGES 1 and 2*		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.031	Physics IAS	3	3
2.001	Chemistry I	2	4
10.001 / 10.011	Mathematics I *or* / Higher Mathematics I†	4	2
Plus one of			
5.001	Engineering I	3	3
25.111	Geoscience I	2	4
		11/12	12/13

* 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 in 1972.

STAGE 3		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.022	Chemistry II (M)	3	4	3	3
4.031	Physics of Metals*	1	3	1	0
10.031	Mathematics	1	1	1	1
	General Studies Elective	1	½	1	½
		6	8½	6	4½
*From Week 12 in Session 1		1	0		

STAGE 4		Hours per week for 2 Sessions Lec.	Lab. Tut.
4.011	Metallurgy I	5	6
25.201	Mineralogy *or*	1	1
5.001	Engineering I (Part A)	2	0
		6/7	5/7

		Hours per week for 2 Sessions	
STAGE 5		Lec.	Lab. Tut.
4.012/1	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			
4.012/2	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)

		Hours per week for 2 Sessions	
STAGE 5A		Lec.	Lab. Tut.
4.012/3	Metallurgy IIC	2	2
4.013/1	Seminar	0	1
4.012/4	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 two courses at graduate level requiring one year of full-time or two years of part-time study leading to the Graduate Diploma (GradDip) in Mining Engineering or Mineral Technology.

Part-time courses in Mining Engineering and Mineral Processing are conducted at the W. S. & L. B. Robinson University College, Broken Hill. The first two years of a full-time course leading to the degree of Bachelor of Engineering have been available at Wollongong since 1970, the third and fourth years of this course to be completed at Kensington. Students in the part-time Mining Engineering course may also complete the requirements for the Bachelor of Engineering degree at Kensington after obtaining the approval of the Head of the School.

Details of the full-time and part-time courses at Wollongong are given in the Wollongong University College Handbook.

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 must realize that the problems of today are complex and require great technical skill. They also must be aware that the future offers an increasing number of opportunities for all mining engineers.

It is obvious that the mining industry will become, because of its spectacular 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 already taking place, particularly in those areas which in the past received little attention, and hidden, sub-surface

deposits are being discovered. After 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.

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.

During the undergraduate course, students are advised to seek practical experience in mines during the long recesses. The minimum requirement of 100 days' industrial experience is to be completed before entering fourth year. Mining companies prepare programmes so that the students obtain special experience in mining. This experience is important; it is related to the academic training received within the School, and can contribute to the experience record of candidates for the Mine Manager's Certificate.

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 exempt from certain parts of the relevant examination.

YEAR 1		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.001 1.031	Physics I *or* Physics IAS	3	3
2.001	Chemistry I	2	4
5.001	Engineering I	3	3
10.001 10.011	Mathematics I *or* Higher Mathematics I	4	2
		12	12

YEAR 2		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
4.941	Materials	0	0	1	1
5.711	Thermodynamics	0	0	1	1
6.801	Electrical Engineering	1	2	1	2
7.110	Mineral Resources Parts 1 & 2	1	0	1	0
8.151	Mechanics of Solids	2	1	2	1
8.250	Properties of Materials	2	2	0	0
8.510	Hydraulics	2	2	0	0
10.022	Mathematics	2	2	2	2
25.101	Geology for Engineers*	0	0	2	2
29.441	Engineering Surveying	1½	1½	1½	1½
29.491	Survey Camp	0	0	0	0
	General Studies Elective	1	½	1	½
		12½	11	12½	11

* Two one-day Geology excursions are an essential part of the course.

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 8.510 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.
7.111	Mining Engineering I—Parts 1 and 2	4	4
7.121	Mine Surveying and Control Engineering	1	1
7.551	Mining and Mineral Process Engineering—Parts 1 and 2	2	2
25.102	Geology for Mining Engineers*	4	3
	Two General Studies Electives	2	1
		13	11

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

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.
7.112	Mining Engineering II*	3	3	3	3
7.113	Mineral Industry Elective Project*	0	5	0	5
7.115 / 7.315	Mining Engineering III *or* Mineral Processing II	1	3	0	0
7.116 / 7.316	Mining Engineering IV *or* Mineral Processing III	0	0	1	3
7.132	Mine Valuation	1	1	0	0
7.133	Mineral Economics	0	0	1	1
7.311	Mineral Processing I*	2	4	2	4
	General Studies Advanced Elective	2	0	2	0
		9	16	9	16

* Part 1 of this subject will be taken in Session 1 and Part 2 in Session 2.

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).

		Hours per week for 2 Sessions	
STAGES 1 and 2*		Lec.	Lab. Tut.
1.001 / 1.031	Physics I *or* Physics IAS	3	3
2.001	Chemistry I	2	4
5.001	Engineering I	3	3
10.001 / 10.011	Mathematics I *or* Higher Mathematics I†	4	2
		12	12

*Two of the first four subjects listed will be taken in Year 1 and the other two in Year 2.
†There will be no evening lectures in this subject in 1972.

		Hours per week			
		SESSION 1		SESSION 2	
STAGE 3		Lec.	Lab. Tut.	Lec.	Lab. Tut.
4.941	Materials	1	1	0	0
7.110/1	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	Mathematics II—Parts 1 & 2	2	2	2	2
		6	4	7	5

		Hours per week for 2 Sessions	
STAGE 4		Lec.	Lab. Tut.
5.611	Fluid Mechanics/Thermodynamics	2	2
7.551/1	Mining and Mineral Process Engineering, Parts 1 and 2*	1	1
	General Studies Elective	1	½
29.441	Engineering Surveying†	1½	0
25.101	Geology for Engineers‡	1	1
		6½	4½

* 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.

		Hours per week for 2 Sessions	
STAGE 5		Lec.	Lab. Tut.
6.801	Electrical Engineering	1	2
7.111/1	Mining Engineering I—Parts 1 and 2	2	2
7.121/1	Mine Surveying and Control Engineering	1	0
25.102/1	Geology for Mining Engineers*	2	2
	General Studies Elective	1	½
		7	6½

* Geology excursion will be conducted during the year.

STAGE 6

7.112/1	Mining Engineering II*	3	2
7.113/1	Mineral Industry Elective Project†	0	2
7.311/1	Mineral Processing I	1	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.

Bachelor of Science (Engineering) (Wollongong University College)

For details of this course potential candidates should refer to the Wollongong University College Handbook.

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.

STAGES 1 and 2*		Hours per week for 2 Sessions Lec.	Lab. Tut.
1.001 1.031	Physics I *or* Physics IAS	3	3
2.001	Chemistry I	2	4
5.001	Engineering I	3	3
10.001 10.011	Mathematics I *or* Higher Mathematics I	4	2
		12	12

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

STAGE 3		Hours per week SESSION 1 Lec.	Lab. Tut.	SESSION 2 Lec.	Lab. Tut.
2.311	Physical Chemistry I	1½	3	1½	3
4.941	Materials	1	1	0	0
8.250	Properties of Materials	0	0	2	2
10.022	Mathematics—Parts 1 and 2	2	2	2	2
	General Studies Elective	1	½	1	½
		5½	6½	6½	7½

STAGE 4		Hours per week for 2 Sessions Lec.	Lab. Tut.
2.511	Analytical Chemistry I	1	3
7.551/1	Mining and Mineral Process Engineering—Parts 1 and 2*	1	1
10.331	Statistics	1	1
25.101/1	Geology for Engineers†	1	1
25.201	Mineralogy	1	1
		5	7

* 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.

		Hours per week for 2 Sessions	
STAGE 5		Lec.	Lab. Tut.
6.801	Electrical Engineering	1	2
7.411	Fluid Mechanics	1	1
7.311	Mineral Processing I—Parts 1 and 2	3	3
	General Studies Elective	1	½
		6	6½

STAGE 6*

7.113/1	Mineral Industry Elective Project, Parts 1 and 2†	0	2
7.312	Mineral Processing 1B	3	4
7.412	Mineral Industry Processes, Parts 1 and 2	1	1
	General Studies Elective	1	½
		5	7½

* Available in 1973.
† 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. The fourth year is common to all four Textile Technology courses.

Textile Technology—Full-Time Course
Bachelor of Science

		Hours per week for 2 Sessions	
YEAR 1 (All courses)		Lec.	Lab. Tut.
1.031	Physics IAS*	3	3
2.001	Chemistry I	2	4
5.001	Engineering I	3	3
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2
		12	12

* Students wishing to take the Textile Physics Option in Second Year may substitute 1.011 Higher Physics I or 1.001 Physics I.

TEXTILE CHEMISTRY

YEAR 2			
1.212	Physics IIT (Unit B)	½	1
2.002	Chemistry II	3	6
10.331	Statistics	1	1
13.111	Textile Technology I	3	5
13.211	Textile Science I	2	1
	General Studies Elective	1	½
		10½	14½

YEAR 3			
2.003A / 2.003B	Chemistry III	2	4
13.112	Textile Technology II	6	7
13.212	Textile Science II	1	0
13.311	Textile Engineering I	1	0
	Two General Studies Electives	2	1
		12	12

TEXTILE PHYSICS

		Hours per week for 2 Sessions	
YEAR 2		Lec.	Lab. Tut.
1.112	Physics II	5	3
10.911	Mathematics II	5	1
10.331	Statistics	1	1
13.111	Textile Technology I	3	5
13.211	Textile Science I	2	1
	General Studies Elective	1	½
		17	11½
YEAR 3			
1.113	Physics III	4	3
13.112	Textile Technology II	6	7
13.212	Textile Science II	1	0
13.311	Textile Engineering I	1	0
	Two General Studies Electives	2	1
		14	11

TEXTILE ENGINEERING

YEAR 2			
5.301	Engineering Mechanics*	1½	½
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	1	1
13.111	Textile Technology I	3	5
13.211	Textile Science I	2	2
	General Studies Elective	1	½
		12½	14

* One session only.

YEAR 3			
5.111	Mechanical Engineering Design	2	2
5.331	Dynamics of Machines	1½	½
6.801	Electrical Engineering	1	2
13.112	Textile Technology II	6	7
13.212	Textile Science II	1	0
13.311	Textile Engineering I	1	0
	Two General Studies Electives	2	1
		14½	12½

TEXTILE MANUFACTURE

		Hours per week for 2 Sessions	
YEAR 2		Lec.	Lab. Tut.
10.331	Statistics	1	1
12.101	Psychology	3	0
13.111	Textile Technology I	3	5
13.211	Textile Science I	2	2
14.111	Accounting I	2	2
15.101	Economics I	2	1
	General Studies Elective	1	½
		14	11½
YEAR 3			
13.112	Textile Technology II	6	7
13.212	Textile Science II	1	0
13.311	Textile Engineering I	1	0
14.321	Business Finance	2	0
26.122	Psychology	1½	½
28.104	Marketing Models and Systems	4	0
	General Studies Elective*	1	½
		16½	8

* Not to include Economics or Psychology.

YEAR 4 (All courses)

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	2	0
		11½	13

* Optional Subjects

13.223 Advanced Textile Chemistry
13.233 Advanced Textile Physics
13.313 Advanced Textile Engineering
14.322 Data Processing and 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 will require 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 will provide the course in Wool and Pastoral Sciences (Education Option), previously offered under the title "Sheep and Wool Technology (Education Option)" within the Board of Vocational 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 B.Sc. 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 obligatory 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.

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 1 Mathematics IT	4	2
17.001	General and Human Biology	2	4
27.001	Geography*	2	4
		10	14

* Students wishing to specialize in Wool Science or Wool Technology may substitute 1.031 Physics IAS, or 1.011 Higher Physics I or 1.001 Physics I for 27.001 Geography I.

YEAR 2

9.101	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	1	1
	General Studies Elective	1	½
		12	15½

		Hours per week			
		SESSION 1		SESSION 2	
YEAR 3		Lec.	Lab. Tut.	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):				
9.122/1	Livestock Production II	1	1	0	0
9.122/2	Livestock Production II	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 9.316	Farm Management IIA *or* Analysis of Rural Development Projects	0	0	2	0
9.532/1	Wool Technology II (Wool Study)	0	2	0	2
9.532/2	Wool Technology II (Wool Metrology)	1	2	1	2
9.532/3	Wool Technology II (Raw Materials)	0	0	2	0
9.602	Animal Physiology II	2	0	2	0

YEAR 4

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.

9.123	Livestock Production III	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
9.533	Wool Technology III	1	1	1	1
9.534	Wool Technology IV	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 IIA	0	0	2	0
9.315	Farm Management IIB	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	Crop Agronomy
						43.101C	Plant Physiology
						43.102E	Environmental Botany
17.001	*General and Human Biology*	9.601	*Animal Physiology I*	9.602	Anim. Physiol. II	9.603	Anim. Physiol. III
		9.101	*Livestock Production I*	9.122/1	L'stck Prodn. II	9.421	Anim. Nutrition
				9.122/2	L'stck Prodn. II	9.123	L'stock Prodn. III
				9.131	*Animal Health and Prev. Medicine I*	9.132	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*	9.801	*Genetics I*	9.811	*Biostatistics*
						9.802	Genetics II
				9.311	*Agricultural Economics I*	9.312	Agric. Economics II
						9.313	Farm Management I
				9.312	Agricultural Economics II	9.314	Farm Management IIA
				9.313	Farm Management I	9.315	Farm Management IIB
				9.314	Farm Management IIA	9.316	Analysis of Rural Development Projects
				9.316	Analysis of Rural Development Projects	9.901	Rural Extension
1.001 1.011 1.031	Physics I	9.531	*Wool Technology I*	9.532/1	Wool Technology II	9.533	Wool Technology III
				9.532/2	Wool Technology II	9.534	Wool Technology IV
				9.532/3	Wool Technology II		

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.

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 B.Sc. degree course in Wool and Pastoral Sciences. As a transition measure students doing Year 2 of the Education Option in 1972 will take a mathematics subject, and 10.331 Statistics will be deferred until Year 3. They will be exempt from the General Studies electives in Year 2 and part of Year 3 by reason of having taken 12.001 Psychology I in Year 1.

		Hours per week for 2 Sessions			
		SESSION 1		SESSION 2	
YEAR 3		Lec.	Lab. Tut.	Lec.	Lab. Tut.
9.122/2	Livestock Production II	1	1	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		Hours per week for 2 Sessions SESSION 1 Lec.	SESSION 1 Lab. Tut.	SESSION 2 Lec.	SESSION 2 Lab. Tut.
9.123	Livestock Production III	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 IIB	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	1	1	1
		14	8	14	10

* 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 Applied Geophysics, Corrosion Technology, Food Technology, Fuel Technology, Polymer Technology, Mineral Technology, Mining Engineering and Wool Technology.

Courses leading to the degree of Master of Applied Science and to Graduate Diplomas are available in Sydney only. Candidates may register for all the research degrees at Sydney. At Wollongong University College and the W. S. and L. B. Robinson University College, Broken Hill, they may register for the degrees of Master

of Science and Master of Engineering, 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

Courses Requiring Attendance at Formal Lectures

Students wishing to enrol in Master of Applied Science or Graduate Diploma courses must make application on the appropriate form to the Registrar at least two months in the case of graduate diplomas and six weeks in the case of Master's degrees, before the commencement of the course. Applicants will be advised whether they are eligible to enrol in the course concerned and of the subsequent procedure to be followed.

Later year enrolments must be made during Enrolment Week in accordance with the special arrangements made by the individual Schools.

No enrolments will be accepted after March 31 without the express approval of the Registrar which will be given in exceptional circumstances only.

Students who have completed the final examinations but have a thesis or project still outstanding are required to enrol for the period necessary to complete the thesis and to pay the requisite fees.

Research Degrees

Details of the procedure to be followed in order to enrol for a research degree are given in the statement of the conditions of award of the various higher degrees as set out in the Calendar.

POSTGRADUATE COURSE FEES*

MASTER OF APPLIED SCIENCE AND GRADUATE DIPLOMA COURSES

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 authorization of course programme.

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 March 31* except with the express approval of the Registrar, which will be given in exceptional circumstances only.

Payment of Fees by Session

Students who are unable to pay their fees by the year may pay by the session in which case they are required to pay Session 1 course fees and other fees for the year within the first two weeks of Session 1. Students paying under this arrangement will receive accounts from the University for Session 2 fees. These fees must be paid within the first two weeks of Session 2.

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.

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

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

Extension of Time

Any student who is unable to pay fees by the due date may apply in writing to the Registrar for an extension of time. Such application must give year of study, state whether full-time or part-time, course in which the applicant wishes to enrol, the reasons why payment cannot be made and the extension sought, and must be lodged before the date on which a late fee becomes payable. Normally the maximum extension of time for payment of fees is until March 31 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 is 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 membership and privileges of the University. 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 course fees for the year is outstanding after the end of the fourth week of Session 2 (18th August, 1972).

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.

Basis of Fee Assessment

Where course fees are assessed on the basis of session hours of attendance, the hours for each subject for purposes of fee assessment shall be those prescribed in the calendar. The granting of an exemption from portion of the requirements of a subject in which a student is enrolled does not carry with it any exemption from the payment of fees.

(a) Master of Applied Science Courses

(i) Registration Fee $7

(ii) Graduation Fee $9

(iii) Course Fee — calculated on the basis of a session's attendance at the rate of $12.50 per hour per week.

Thus the fee for a programme requiring an attendance of 24 hours per week for the session is 24 x $12.50 = $300 per session.

(iv) Thesis or Project Fee—$49 (an additional fee of $33* is payable by students who have completed their final examinations for the degree but have not completed the thesis or project for which they have been previously enrolled).

(v) Thesis or Project Resubmission Fee† $33

(b) Graduate Diploma Courses

(i) Registration Fee $7

(ii) Award of Diploma Fee $9

(iii) Course Fee — calculated on the basis of a session's attendance at the rate of $12.50 per hour per week. Thus the fee for a programme requiring an attendance of 24 hours per week for the session is 24 x $12.50 = $300 per session.

(iv) Thesis or Project Fee—$49 (an additional fee of $33* is payable by students who have completed final examinations for the diploma but have not completed the thesis or project for which they have been previously enrolled).

(v) Thesis or Project Resubmission Fee† $33

(c) Miscellaneous Subjects

Postgraduate subjects taken as "Miscellaneous Subjects" (i.e. not for a degree or diploma) or to qualify for registration as a candidate for a higher degree are assessed on the basis of a session's attendance at the rate of $12.50 per hour per week. Thus the fee for a subject requiring an attendance of 2 hours per week for the sessions is 2 x $12.50 = $25.00 per session.

Other Fees

In addition to the course fees set out above, students in categories (a) and (b) are required to pay:

Library Fee—

Annual Fee, $16.

University Union—entrance fee—$20.

* Students paying this fee who are not in attendance at the University are not required to pay the Student Activities Fees or the Library Fee.

† Candidates paying this fee are not required to pay the Student Activities Fees or the Library Fee.

Student Activities Fees—

University Union†—$30—annual subscription.
Sports Association†—$4—annual subscription.
Students' Union†—$6—annual subscription.
Miscellaneous—$17—annual fee.

Examinations conducted under special circumstances —$9 for each subject.

Review of examination result—$9 for each subject.

Late Fees

First Session

Fees paid from commencement of third week of the session to March 31	$16
Fees paid after March 31 where accepted with the express approval of the Registrar (see above)	$33

Second Session

Fees paid in third and fourth weeks of the session	$16
Fees paid thereafter	$33
Late lodgement of corrected enrolment details form (Late applications will be accepted for three weeks only after the prescribed dates.)	$7

Withdrawal

Students withdrawing from a course are required to notify the Registrar in writing. Fees for the course accrue until a written notification is received.

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 other than Registration Fee will be made.

Where a student terminates for acceptable reasons a course of study before half a session has elapsed, one half of the session's course fees may be refunded. Where a student terminates a course of study after half a session has elapsed, no refund may be made in respect of that session's fees.

The Library Fee is an annual fee and is not refundable where notice of withdrawal is given after the commencement of Session 1. On notice of withdrawal a partial refund of the University

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

Union Entrance Fee is 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.

On notice of withdrawal a partial refund of the Student Activities Fees is made on the following basis:

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

University of New South Wales Students' Union—where notice is given prior to the end of the fifth week of Session 1 $3, 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—where notice is given prior to 30th April $8.50, thereafter no refund.

RESEARCH DEGREES — FEES

(a) Master of Science* and Master of Engineering*

Fees are payable from the commencement date of a candidate's registration and remain payable until the candidate's thesis is presented to the Examinations Branch.

(i)	Qualifying Examination	$16
(ii)	Registration Fee	$7
(iii)	Internal full-time student annual fee	$98
	Internal full-time student session fee	$49
(iv)	Internal part-time student annual fee	$49
	Internal part-time student session fee	$24.50
(v)	External student annual fee†	$33
(vi)	Final Examination	$49
(vii)	Thesis Resubmission Fee†	$49

* Candidates registered under the conditions governing the award of this degree without supervision will pay the following fees: Registration fee $7; Examination of thesis $98. They are not required to pay the Student Activities Fees or the Library Fee.

† Students in this category are not required to pay the Student Activities Fees or the Library fee.

(b) Doctor of Philosophy

(i) Qualifying Examination	$16
(ii) Registration Fee	$7
(iii) Annual Fee	$98
(iv) Final Examination	$66.50
(v) Thesis Resubmission Fee†	$66.50

(c) Doctor of Science

(i) Registration Fee	$103

(d) Research Degree

Continuation Fee* $33

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 before the end of the next session, may pay, in lieu of the normal fees, a Continuation Fee of $33. The payment must be accompanied by a statement from the candidate's Head of School certifying that his work for the degree has reached this stage. If the thesis has not been submitted by the end of the session for which the concession was given, registration will revert to part-time candidature as from the beginning of the year with consequential adjustment of fees.

(e) Miscellaneous Subjects

Postgraduate subjects taken as "Miscellaneous Subjects" (i.e. not for a degree or diploma) or to qualify for registration as a candidate for a higher degree are assessed on the basis of a session's attendance at the rate of $12.50 per hour per week. Thus the fee for a subject requiring an attendance of 2 hours per week for the session is 2 x $12.50 = $25 per session.

Research

One day per week—$33 per annum.

Two or three days per week—$64 per annum.

Four or five days per week—$98 per annum.

* Students paying this fee who are not in attendance at the University are not required to pay the Student Activities Fees or the Library Fee.

† Candidates paying this fee are not required to pay the Student Activities Fees or the Library Fee.

OTHER FEES

In addition to the fees set out above, all students in the categories (a) and (b) are required to pay:

Library Fee—Annual fee, $16.

University Union—$20—entrance fee.

Student Activities Fees—

University Union†—$30—annual subscription.

Sports Association†—$4—annual subscription.

Students' Union†—$6—annual subscription.

Miscellaneous—$17—annual fee.

LATE FEES

Initial Registration

Fees paid from commencement of sixth week after date of offer of registration to end of eighth week $16

Renewal at Commencement of each Academic Year

Fees paid from commencement of third week of Session 1. to March 31 .... $16

Fees paid after March 31 where accepted with the express approval of the Registrar $33

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

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 Postgraduate 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 three referees, to be forwarded direct to the Registrar. If possible, one of the reports should be from a professor, and all three should be from people familiar with the applicant's academic and professional performance.

Unless otherwise stated, the annual stipend for all scholarships is $2,600 per annum and a dependants' allowance at the rate of $450 per annum for a dependent wife and child (or children).

University Postgraduate 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.

Commonwealth Postgraduate Course Awards

The Commonwealth 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 who are under 45 years of age on 1st January of the year in which the award is to be taken up and who are University graduates or will graduate in the current academic year, are eligible for the awards. They receive a stipend of $2,600 paid over the academic year. Other allowances are identical with those contained in the General Conditions, page 121

Applications for awards tenable at this University must be lodged with the Registrar by 30th September each year.

Commonwealth Postgraduate Research Awards

The Commonwealth Government is providing each year a number of awards for postgraduate study and research. The awards will be tenable for one year but may be extended for a period of up to four years.

Persons permanently domiciled in Australia and who are University graduates or who will graduate in the current academic year, are eligible.

The General Motors-Holden's Postgraduate Research Fellowships

General Motors-Holden's Limited has agreed to provide annually eight post-graduate research fellowships throughout Australia, three to be tenable in universities in New South Wales and the Australian Capital Territory. Graduates in any Faculty may apply, but preference will be given to graduates in Engineering, Science, Commerce or Economics. Stipend ranges in value from $3,000 to $3,400 p.a.

Atmospheric Pollution Research Fellowships

Fellowships for research on atmospheric pollution, having an annual value of $2,600-$4,000* each, are available to graduates in Science or Chemical Engineering. The fellowships are tenable for one year but may be re-awarded for a second or third year.

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 $500 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 $250 in each year. Applications must be lodged by 31st December each year.

Environmental Pollution Control Scholarships

Envirotech Australia Pty. Ltd. and George Kent (A.N.Z.) Pty. Ltd. each provide a scholarship for students proceeding to the degree of Master of Applied Science in Environmental Pollution Control. The scholarships have a value of $850 and are normally tenable for one year of full-time study. However, the awards may also be granted to students doing the course in two years of part-time study, in which case the value is $425 per annum. 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 of $1,000 per annum and is normally tenable for one year. Applications must be lodged by 31st December each year.

The Broken Hill Pty. Co. Ltd. Postgraduate Scholarships in Metallurgy

These scholarships are designed to promote study and research for a higher degree at Kensington and Wollongong University College in some branch of Metallurgy which has a direct relation to the activities of the donor company. Graduates in Science or Engineering are eligible to apply. The award carries an annual stipend of $2,700 and a dependant's allowance of $500, and is tenable for one to four years.

Foundry Research Fellowships in Metallurgy

Fellowships for research on foundry metallurgy, having an annual value up to $3,000 each, are available to graduates in metallurgy and related disciplines. The fellowships are financed from the Foundry Research Trust Fund, set up by the Foundry Research Association. Holders of the awards are required to work for a higher degree. The Fellowships are tenable for a maximum of three years, subject to annual renewal.

Australian Wool Board Research Scholarships in Textile Technology

Several scholarships are provided by the Australian Wool Board 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 up to $2,800 per annum, plus fees and certain allowances and are tenable for a maximum of four years, subject to annual renewal.

Australian Wool Board Research Scholarships in Wool and Pastoral Sciences

Scholarships provided by the Australian Wool Board 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 up to $2,800 per annum plus fees and 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.

Commonwealth Service Awards

The field of study is unrestricted. The awards are available only to officers of the Commonwealth Service. Enquiries should be directed to the Commonwealth Public Service Board, Canberra.

C.S.I.R.O. Studentships

Studentships have a value of $2,800 per annum, plus compulsory university fees, and allowances for dependants and for maintenance and travel expenses. Duration of awards 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 12th November.

Rothmans Fellowships Award

The field of study is unrestricted. The range of value of the awards is: Junior, Grade 1—$2,200 to $3,500* p.a.; Junior, Grade 2—Not more than $6,750* 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.

Department of Supply Postgraduate Studentships

Studentships are available at any Australian university for full-time study and research for the degree of Doctor of Philosophy in specified fields which vary from year to year. Normally they are awarded for a period of three years. Applicants must possess or expect to possess by the beginning of the 1972 academic year a 1st or 2nd Class Honours Degree or a Master's Degree in Science, Engineering or Mathematics. Commencing salary—1st or 2nd Class Honours Degree, $5,171; Master's Degree, $6,090. Maximum salary $6,625. Compulsory fees are paid by the Department. A bond of service is required. Studentships will be advertised in the daily press late in October. Applications should be lodged with Secretary, Department of Supply, Canberra, A.C.T., 2600.

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

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 $2,350 to $2,650, plus University fees. The Institute also provides awards for post-doctoral research for one year renewable. The value of these awards is $4,500 to $6,000 p.a.

* Exempt University tuition fees.

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. plus university fees 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 range of value of the awards is $2,500 to $2,800 p.a., plus fees and 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 to the Secretary, C.S.I.R.O., 314 Albert Street, East Melbourne, Vic., 3002, by 31st July.

OUTLINES OF POST-GRADUATE 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 (M.App.Sc.) and Graduate Diploma courses (Grad. Dip.) which contain a substantial component of formal study are available from a number of Schools in the Faculty. The School of Applied Geology offers a Master of Applied Science course in Hydrogeology, and the School of Chemical Engineering offers Master of Applied Science courses in Chemical Engineering, Biological Process Engineering and Environmental Pollution Control. Graduate Diploma courses are offered: in Applied Geophysics by the School of Applied Geology; 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 Engineering and in Mineral Technology by the School of Mining Engineering; and in Wool Technology by the School of Wool and Pastoral Sciences.

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

Hydrogeology 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. It is designed to provide a bridge between water engineering and geology for graduates who wish to study and work in the field of water resources.

The normal requirement for admission to the course is a degree of Bachelor with Honours with geology as a major subject. Other graduates with suitable academic and professional attainments may be permitted to register for the course.

The following programme may be completed in either one year on a full-time basis or two years on a part-time basis.

		Hours per week for 2 Sessions	
		Lec.	Lab. Tut.
8.557G	Engineering Hydrology	1½	1½
8.558G	Groundwater Hydrology	1½	1½
25.401G	Groundwater Investigations	1½	1½
25.402G	Hydrogeology	1½	1½
25.403G	Project	0	9
27.901G	Geomorphology for Hydrologists	1	2
		7	17

Applied Geophysics Graduate Course (Graduate Diploma)

The aim of this course is to train suitable graduates in Applied Science, Science and Engineering who wish to become applied or exploration geophysicists. The pre-requisites for the course are Physics and a Mathematics to second-year level, and Geology to first year level, in a first degree in Applied Science, Science or Engineering.

The Graduate Diploma in Applied Geophysics (Grad. Dip.) will be awarded on the successful completion of one year of full-time study.

		Hours per week for 2 Sessions Lec./Lab.
6.168G	Potential and Systems Theory in Geophysics	2
6.841	Electronic Instrumentation	2
10.331	Statistics†	1½
25.111G	Geology	4
25.321G	Geophysics	6
29.441	Engineering Surveying	1½
		17

† Students who have satisfactorily completed a statistics course equivalent to 10.331 may elect to take the statistics components of 10.061G in the Master of Engineering Science course in Electrical Engineering.

SCHOOL OF CHEMICAL ENGINEERING

Formal courses in 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.

Chemical Engineering Graduate Courses (Master of Applied Science)

The MAppSc courses provide for a comprehensive study of theoretical and practical aspects of many advanced topics in Chemical Engineering. They are designed to allow the maximum content 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.

These principles are embodied in the following examples:

1. A graduate course for chemical engineers wishing to practise in the food industries

		Hours per week for 2 Sessions
3.241G	Food Technology	4
3.242G	Treatment of Biological Effluents	2
18.551	Operations Research *or*	3
28.104	Marketing Models and Systems	4
42.201G	Principles of Biology	1
42.202G	Principles of Biochemistry	2½
44.111	Microbiology	3
3.900G	Project*	

2. A graduate course for chemical engineers wishing to specialize in air pollution fields

25.701G	Subsurface Geology and Pollution Control	1
27.902G	Meteorological and Hydrological Principles	1
27.903G	Geographic Background to Pollution Problems	½
3.162G	Urban Planning	1
3.164G	Medical and Legislative Aspects	1
3.391G	Atmospheric Pollution and Control	2
3.394G	Thermal Engineering and Fuel Processing	3
23.051	Nuclear Power Technology	3
	A course on Statistics *or* Data Processing	
	A course in Meteorology	
3.900G	Project*	

* See para. 3, p. 129.

Biological Process Engineering Graduate Course (Master of Applied Science)

The graduate course in Biological Process Engineering leads to the degree of Master of Applied Science. It extends over one full-time year or two part-time years. This course is primarily intended for candidates who have completed a four year degree programme in Chemical Engineering, but candidates from other disciplines in science or engineering may be admitted if the appropriate pre-requisites are taken.

The course provides appropriate biological, microbiological and biochemical training for those involved in the application of advanced engineering principles to problems peculiar to large scale industrial biological processes. The engineering principles provided in the course cover process dynamics and design, thermodynamics, heat, mass and momentum transport with particular emphasis on and application to continuous biological processes.

		Hours per week for 2 Sessions Lec./Lab.
3.461G	Physical Transport Processes	2
3.462G	Thermodynamics and Theory of Rate Processes	1
3.463G	Bioprocess Dynamics and Plant Design	3
3.464G	Continuous Culture Processes	1
42.201G	Theoretical Biology	1
42.202G	Principles of Biochemistry	2½
42.203G	Biochemical Methods	1½
42.204G	Microbial Processes	1
44.111	Microbiology	3
3.900G	Project*	–
		16

* See para. 3, p. 129.

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 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
27.903G	Geographic Background to Pollution Problems	½
44.111	Microbiology	3
(c)		
3.163G	Industrial Use and Re-use of Water	1
3.242G	Treatment of Biological Effluents	2
3.391G	Atmospheric Pollution and Control	2
3.396G	Unit Operations in Waste Management	1
	Optional Elective(s) and Theoretical Project *or*	3
3.900G	Project*	
		14/17

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 the Theoretical Project must be embodied in a report and submitted in accordance with the requirements of the School.

* See para. 3, p. 129.

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.

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 post-graduate levels. The Diploma in Food Technology (Grad. Dip.) 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 Lec./Lab.
2.271G	Chemistry and Analysis of Foods	3
3.231	Food Engineering	3
3.241G	Food Technology	4
42.201G	Principles of Biology	1
42.202G	Principles of Biochemistry	2½
42.203G	Biochemical Methods	1½
42.204G	Microbial Processes	1
44.111	Microbiology	3
		18

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 post-graduate 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

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

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.
22.321G	Polymer Engineering I	2	5	2	0
22.331G	Polymer Chemistry I	2	0	2	5
		4	5	4	5
YEAR 2—PART-TIME					
22.322G	Polymer Engineering II	2	0	2	5
22.332G	Polymer Chemistry II	2	5	2	0
		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.

SCHOOL OF MINING ENGINEERING

The School offers two postgraduate courses, one in Mineral Technology and the other in Mining Engineering, both leading to the award of a Graduate Diploma (GradDip).

Mineral Technology Graduate Course (Graduate Diploma)

The Graduate Diploma Course in Mineral Technology is designed to provide professional training for graduates in Science, Applied Science or Engineering who wish to specialize in the fields of mineral processing, including coal preparation. The course is concerned primarily with instruction in the scientific and engineering principles associated with the beneficiation of minerals and coal to convert them to marketable commodities.

The Graduate Diploma in Mineral Technology (Grad. Dip.) will be awarded on the successful completion of one year of full-time or two years of part-time study. The course is a blend of lecture and laboratory work and allows the choice of elective specialization in either the beneficiation of minerals or the preparation of coal.

		Hours per week	
		SESSION 1	SESSION 2
YEAR 1—PART-TIME		Lec./Lab.	Lec./Lab.
7.391G	Mineral Processing	0	5
7.551	Mining and Mineral Process Engineering, Parts 1 and 2	4	0
25.201	Mineralogy, Parts 1 and 2	2	2
		6	7
YEAR 2—PART-TIME			
7.392G	Mineral Processing Technology, Parts 1 and 2	3	3
7.393G	Mineral Engineering—Laboratory	3	3
		6	6

When appropriate, up to 3 hours per week may be selected from approved courses offered by other Schools within the University.

Mining Engineering Graduate Course (Graduate Diploma)

The postgraduate course leading to a Graduate Diploma in Mining Engineering (Grad. Dip.) has been established to provide graduate students in the fields of engineering, surveying, and some areas of applied science with advanced training in the following aspects of mining engineering:

Tunnelling and quarrying.

Metalliferous and coal mining.

Petroleum engineering and other non-entry methods.

It should be noted that some degree of specialization will be possible in the mining engineering laboratory investigations.

The following programme may be completed in one year of full-time study or over two years on a part-time basis.

		Hours per week	
		SESSION 1	SESSION 2
YEAR 1—PART-TIME		Lec./Lab.	Lec./Lab.
7.121	Mine Surveying and Control Engineering	2	0
7.191G	Mining Engineering	0	6
7.551	Mining and Mineral Process Engineering, Parts 1 and 2	4	0
		6	6
YEAR 2—PART-TIME			
7.192G	Mining Engineering Technology, Parts 1 and 2	4	4
7.193G	Mining Engineering Laboratory	3	3
		7	7

Where appropriate, up to three hours per week may be devoted to approved courses offered by other Schools within the University.

SCHOOL OF WOOL AND PASTORAL SCIENCES

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 B.Sc. 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:

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

The undergraduate subjects may be chosen to suit the requirements of the student, subject to their availability. The Graduate Diploma students are expected to work at the level of honours students in the undergraduate course and to carry out prescribed study of current research material in the 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)

Undergraduate students in all faculties other than Arts are required to study a number of General Studies subjects. Text 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

For students taking 2 full years of Physics

TEXTBOOKS

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

Bueche, F. *A Workbook in Physics for Science and Engineering Students,* McGraw-Hill.

Dunlop, J. I., and Mann, K. *Introductory Electronics.* Clarendon.

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

1.011 Higher Physics I

TEXTBOOKS

Halliday, D., and Resnick, R. *Physics for Students of Science and Engineering.* Vols. I and II, or combined volume. Wiley, 1960.

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.

1.031 Physics I (For students taking only **one** year of Physics)

TEXTBOOKS

Giutronich, J. E. *Electricity*. Clarendon.

Halliday, D., and Resnick, R. *Physics for Students of Science and Engineering*. Vol. I. Wiley, 1960.

Lishmund, R. E. *Introductory Physical and Geometrical Optics*. N.S.W.U.P.

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

Marsden, K., and Russell, G. J. *Laboratory Notes for Physics I.*

1.113A Wave Mechanics and Spectroscopy

TEXTBOOKS

Beiser, A. *Perspectives of Modern Physics*. Rev. ed. McGraw-Hill, 1969.

Coster, H. G. L. *Experimental Physics*. N.S.W.U.P.

1.113B Electromagnetic Fields and Physical Optics

TEXTBOOK

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

1.113C Statistical Mechanics and Solid State

TEXTBOOKS

Blakemore, J. S. *Solid State Physics*. W. B. Saunders, 1969.

Jackson, E. A. *Equilibrium Statistical Mechanics*. Prentice-Hall, 1968.

1.113D Astrophysics and Nuclear Physics

TEXTBOOK

Tayler, R. J. *The Stars, Their Structure and Evolution*. Wyneham Science Series.

1.123A Quantum Mechanics

TEXTBOOK

Schiff, L. I. *Quantum Mechanics*. 2nd ed. McGraw-Hill.

1.123B Electromagnetic Theory and Statistical Mechanics

TEXTBOOKS

Corson, D., and Lorrain, P. *Introduction to Electromagnetic Fields and Waves*. Freeman.

Reif, F. *Fundamentals of Statistical and Thermal Physics*. McGraw-Hill.

1.123C Solid State and Nuclear Physics

TEXTBOOKS

Burcham, W. E. *Nuclear Physics and Introduction*. Longmans, 1963.

Kittel, C. *Introduction to Solid State Physics*. 3rd ed. Wiley, 1967.

1.123D Atomic Physics and Spectroscopy

TEXTBOOKS

McDaniel, E. W. *Collision Processes in Ionised Gases*. Wiley, 1964.

White, H. W. *Introduction to Atomic Spectra*. McGraw-Hill, 1934.

1.143B Solid State Devices and Electronics

Gibbons, J. F. *Semiconductor Electronics*. McGraw-Hill, 1966.

S.C.R. Handbook. General Electric Co.

1.143C Magnetism

TEXTBOOK
None prescribed.

1.212 Physics IIT

Unit B (Electronics)
TEXTBOOK
Smith, R. J., *Circuits, Devices and Systems Theory*. 2nd ed. Wiley, 1972.
Unit C (Introduction to Physics of Solids)
TEXTBOOK
Thomson, R. M., and Wert, C. A. *Physics of Solids*. Int. Student ed. McGraw-Hill, 1964.

SCHOOL OF CHEMISTRY

2.001 Chemistry I

TEXTBOOKS
Ander, P., and Sonnessa, A. J. *Principles of Chemistry*. Collier-Macmillan, 1966.
Aylward, G. A., and Findlay, T. J. V. eds. *SI Chemical Data*. Wiley, 1971.
Barrow, G. M., Kenney, M. E., Lassila, J. D., Litle, R. L., and Thompson, W. E. *Understanding Chemistry*. Benjamin, 1969.
Chemistry I Laboratory Manual. N.S.W.U.P., 1971.
Hart, H. & Schuetz, R. D. *Organic Chemistry*. Feffer and Simons, 1967.
Schaum Outline Series. *Theory and Problems of College Chemistry*. McGraw-Hill.
Turk, A., Meislich, H., Brescia, F., and Arents, J. *Introduction to Chemistry*. Academic Press, 1968.

2.002 Chemistry II

This course consists of three strands, 2.002A, B, C as follows:

2.002A Chemistry II (Physical Chemistry)

TEXTBOOKS
Aylward, G. H., and Findlay, T. J. V. eds. *SI Chemical Data*. Wiley, 1971.
Barrow, G. M. *Physical Chemistry*. 2nd ed. McGraw-Hill, 1966.
Daniels, F. et. al. *Experimental Physical Chemistry*. 7th ed. McGraw-Hill, 1970.
Shaw, D. J. *Introduction to Colloid and Surface Chemistry*. 2nd ed. Butterworth, 1970.

2.002B Chemistry II (Organic Chemistry)

TEXTBOOKS
Morrison, R. T., and Boyd, R. N. *Organic Chemistry*. 2nd ed. Allyn & Bacon, 1966.

One of the following:
Cheronis, N. D., and Entrikin, J. B. *Identification of Organic Compounds*. Wiley International Edition.
Shriner, R. L., Fuson, R. C., and Curtin, D. Y. *Systematic Identification of Organic Compounds*. 5th ed. Wiley, 1964.

Vogel, A. I. *Elementary Practical Organic Chemistry*. Pt. II. Qualitative Organic Analysis. Longmans, 1957.

2.002C Chemistry II (Inorganic Chemistry)

TEXTBOOKS

Day, R. A., and Underwood. *Quantitative Analysis*. Prentice Hall, 1967.

Hamilton, L. E., and Simpson, S. *Calculations of Analytical Chemistry*. 7th ed. McGraw-Hill, 1968.

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.

2.003A Chemistry III (Physical Chemistry)

TEXTBOOKS

Barrow, G. M. *Physical Chemistry*. 2nd ed. McGraw-Hill, 1966.

Daniels, F. et al. *Experimental Physical Chemistry*. 7th ed. McGraw-Hill, 1970.

Dixon, R. N. *Spectroscopy and Structure*. Methuen, 1965.

Laidler, K. J. *Chemical Kinetics*. 2nd ed. McGraw-Hill, 1965.

2.003B Chemistry III (Organic Chemistry)

TEXTBOOKS

Morrison, R. T., and Boyd, R. N. *Organic Chemistry*. 2nd ed. Allyn & Bacon, 1966, *or*

Roberts, J. D., and Caserio, M. C. *Basic Principles of Organic Chemistry*. Benjamin, 1964.

Tedder, J. M., Nechvatal, A., Murray, A. W., and Carnduff, J. *Basic Organic Chemistry*. Pt. 3. Wiley, 1970.

One of the following:

Cheronis, N. D., and Entrikin, J. B. *Identification of Organic Compounds*. Wiley International Edition.

Shriner, R. L., Fuson, R. C., and Curtin, D. Y. *Systematic Identification of Organic Compounds*. 5th ed. Wiley, 1964.

Vogel, A. I. *Elementary Practical Organic Chemistry*. Pt. II. Qualitative Organic Analysis. Longmans, 1957.

2.022 Chemistry IIM

Units 2.002A (Physical Chemistry) and 2.002C (Inorganic Chemistry) of 2.002 Chemistry II (Science).

2.211 Applied Organic Chemistry

No prescribed textbook.

2.221 The Chemistry and Enzymology of Foods

No prescribed textbook.

2.261 The Chemistry and Enzymology of Foods

No prescribed textbook.

2.311 Physical Chemistry I

TEXTBOOKS

Aylward, G. H., and Findlay, T. J. V. eds. *SI Chemical Data.* Wiley, 1971.
Barrow, G. M. *Physical Chemistry.* 2nd ed. McGraw-Hill, 1966.
Daniels, F. et al. *Experimental Physical Chemistry.* 7th ed. McGraw-Hill, 1970.
Shaw, D. J. *Introduction to Colloid and Surface Chemistry.* 2nd ed. Butterworth, 1970.

2.322 Physical Chemistry II

TEXTBOOKS

Barrow, G. M. *Physical Chemistry.* 2nd ed. McGraw-Hill, 1966.
Daniels, F. et al. *Experimental Physical Chemistry.* 7th ed. McGraw-Hill, 1970.
Dixon, R. N. *Spectroscopy and Structure.* Methuen, 1965.
Laidler, K. J. *Chemical Kinetics.* 2nd ed. McGraw-Hill, 1965.

2.331 Applied Physical Chemistry

No prescribed textbook.

2.411 Inorganic Chemistry I

TEXTBOOK

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.

2.511 Analytical Chemistry I

TEXTBOOKS

Ewing, G. W. *Instrumental Methods of Chemical Analysis.* McGraw-Hill, 1969.
Fischer, R. B., and Peters, D. G. *Quantitative Chemical Analysis.* W. B. Saunders, 1968.
Hamilton, L. F., and Simpson, S. *Calculations of Analytical Chemistry.* 7th ed. McGraw-Hill, 1968.

2.611 Organic Chemistry I

TEXTBOOKS

Morrison, R. T., and Boyd, R. N. *Organic Chemistry.* 2nd ed. Allyn & Bacon, 1966.

One of the following:

Cheronis, N. D., and Entrikin, J. B. *Identification of Organic Compounds.* Wiley International Edition.
Shriner, R. L., Fuson, R. C., and Curtin, D. Y. *Systematic Identification of Organic Compounds.* 5th ed. Wiley, 1964.
Vogel, A. I. *Elementary Practical Organic Chemistry.* Pt. II. *Qualitative Organic Analysis.* Longmans, 1957.

SCHOOL OF CHEMICAL ENGINEERING

GENERAL

In addition to drawing instruments, set squares, protractor and scale-rules, which will be obtained as specified for subject 5.001 Engineering I, 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.

3.111 Chemical Engineering Principles I

(*a*) *Principles of Momentum Transfer*—Introduction and units. Classification of fluids—Newtonian and non-Newtonian flow, pressure gauges and manometers. Fluid pressure in pipes and cylinders. Fluid motion, critical velocity, Reynolds number. Bernoulli's theorem—flow in converging and diverging ducts. Orifice and venturi meters—weirs—rotameters. Flow of compressible and non-compressible fluids and Pitot tubes and gas flow measurement.

(*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., and Richardson, J. *Chemical Engineering.* Vol. 1. Pergamon.

McCabe, W. L., and Smith, J. C. *Unit Operations of Chemical Engineering.* 2nd ed. McGraw-Hill.

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

REFERENCE BOOKS

Allcock, H., Jones, J. & Michel, J. *The Nomogram.* Pitman.

Badger, W. & Banchero, J. *Introduction to Chemical Engineering.* McGraw-Hill.

Corcoran, W. & Lacey, N. *Introduction to Chemical Engineering Problems.*
Davies, O. *Statistical Methods in Research and Production.*
Eckert, E. & Drake, R. *Heat and Mass Transfer.*
Haslam, R. & Russell, R. *Fuels and their Combustion.* McGraw-Hill.
Hougen, O., Watson, K. & Ragatz, R. *Chemical Process Principles.* Vol. 1. Wiley.
Johnson, L. H. *Nomography and Empirical Equations.*
Johnstone, R. & Thring, H. *Pilot Plant Models and Scale-up Methods in Chemical Engineering.* McGraw-Hill.
Knudson, D. J. & Katz, D. *Fluid Dynamics and Heat Transfer.*
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.
Mickley, H. Sherwood, T. & Reed, C. *Applied Mathematics in Chemical Engineering.* McGraw-Hill.
Schmidt, A. & List, M. *Material and Energy Balances.* Prentice Hall.
Worthing, A. & Geffner, J. *Treatment of Experimental Data.*

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.

TEXTBOOK

Perry, J. H., ed. *Chemical Engineers' Handbook.* 4th Ed. McGraw-Hill, 1963.

REFERENCE BOOKS

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

3.121 Chemical Engineering, Principles II

Mass Transfer—Mechanism of mass transfer, diffusivity, characteristics of phase contactors. Stage and transfer unit calculations applied to solid-liquid, gas-liquid, liquid-liquid, solid-gas and vapour-liquid operations. Penetration and surface renewal theories. Simultaneous heat and mass transfer, phase equilibria based on humidity—temperature relationships, psychometric charts. Vaporization and condensation processes. Heat mass and momentum analogies.

Heat Transfer—Heat transfer to boiling liquids and condensing vapours. Evaporation and crystallization processes. Unsteady state heat transfer to solids and fluids.

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

Coulson, J. M., and Richardson, J. F. *Chemical Engineering.* Vol. 2. Pergamon.

Kreith, F. *Principles of Heat Transfer.* International Text Book Co.

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

REFERENCE BOOKS

Bennett, C. O., and Myers, J. E. *Momentum, Heat and Mass Transfer,* McGraw-Hill.

Carslaw, H. S., and Jaeger, J. C. *Conduction of Heat in Solids.* Oxford, 1947.

Foust, A. S. et al. *Principles of Unit Operations.* Wiley.

Kern, D. Q. *Process Heat Transfer.* McGraw-Hill, 1950.

Larian, M. G. *Fundamentals of Chemical Engineering Operations.* Constable.

Levenspiel, O. *Chemical Reaction Engineering.* Wiley, 1962.

McAdams, W. H. *Heat Transmission.* 3rd ed. McGraw-Hill, 1954.

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

Dasent, W. E. *Inorganic Energetics.* Penguin, 1970.

Hougen, O., Watson, K., and Ragatz, R. *Chemical Process Principles.* Part II. 2nd ed. Wiley.

Levenspiel, O. *Chemical Reaction Engineering.* 2nd ed. Wiley.

REFERENCE BOOKS

Astarita, G. *Mass Transfer with Chemical Reaction.* Elsevier, 1967.

Danckwerts, P. V. *Gas-Liquid Reactions.* McGraw-Hill, 1970.

Denbigh, K. G., and Turner, J. C. R. *Chemical Reactor Theory. An Introduction.* 2nd ed. C.U.P., 1971.

King, M. B. *Phase Equilibria in Mixtures.* Pergamon, 1969.

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.
Van Zeggereu, F., and Storey, S. H. *The Computation of Chemical Equilibria.* C.U.P.

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. Service fluids for heating and cooling at various temperature levels. Development and use of film resistance models. Construction and design of shell and tube exchangers for liquids, gases, condensing vapours and boiling liquids. Design of pipe and plate type exchangers.

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. Brief outline of flexural considerations.

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.

Industrial Measuring Instruments—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.

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.

TEXTBOOKS

Coughanowr, D. R., and Koppel, L. B. *Process Systems Analysis and Control.* McGraw-Hill, 1965.
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., and Timmerhaus, K. D. *Plant Design and Economics for Chemical Engineers.* 2nd ed. McGraw-Hill.
Rase, H. F. *Piping Design for Process Plants.* Wiley.
Uhlig, H. H. *Corrosion and Corrosion Control.* Wiley, 1963.
A.S. No. CB 1, Part V—1955 S.A.A. *Boiler Code, Part V—Welding.* Standards Association of Australia.
B.S. 3274:1960 *Tubular Heat Exchangers.* British Standards Institution.

REFERENCE BOOKS

Brownell, L. E., and Young, E. H. *Process Equipment Design.* Wiley.
Buchanan, R. H., and Sinclair, C. G. *Costs and Economics of the Australian Process Industries.* West.
Kern, D. *Process Heat Transfer.* McGraw-Hill, 1950.
Treybal, R. E. *Mass Transfer Operations.* 2nd ed. McGraw-Hill, 1968.

3.124 Chemical Engineering Design and Practice

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.

3.131 Chemical Engineering Principles III

Optimization methods. Computer programming and operating systems and mathematical modelling. An advanced treatment of combined heat, mass and momentum transfer and the equations of conservation from the transport phenomena viewpoint.

TEXTBOOKS

Beveridge, G. S., and Schechter, R. S. *Optimization Theory and Practice.* McGraw-Hill, 1970.
Bird, R. B., Stewart, W. E., and Lightfoot, E. N. *Transport Phenomena.* Wiley, 1962.
Conte, S. D. *Elementary Numerical Analysis.* McGraw-Hill, 1965.

REFERENCE BOOKS

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.

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. (*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. (*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.* Wiley, 1963.

Rudd, D. F., and Watson, C. C. *Strategy of Process Engineering.* Wiley.

A.S. No. CB1, Part V—1951, *S.A.A. Boiler Code Part V, Welding.* Standards Assoc. Australia.

REFERENCE BOOKS

Astarita, G. *Mass Transfer with Chemical Reaction.* Elsevier, 1967.

Buchanan, R. H., and Sinclair, C. C. eds. *Costs and Economics of the Australian Process Industries.* West.

Industrial Ventilation. Amer. Soc. of Govt. Indus. Hygienists. Washington, 1966.

Jelen, F. C. ed. *Cost and Optimization in Engineering.* McGraw-Hill, 1970.

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

An advanced treatment of the principles of chemical engineering including stagewise operations, fluid and particle mechanics, diffusion and separation and heat transfer.

TEXTBOOKS

Bird, R. B., Stewart, W. E., and Lightfoot, E. N. *Transport Phenomena.* Wiley, 1962.

Hughes, W. F. and Brighton, J. A. *Fluid Dynamics.* Schaum, 1967.

REFERENCE BOOKS

Treybal, R. *Mass Transfer Operations.* McGraw-Hill, New York, 1968.

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.

TEXTBOOKS

As for 3.134 Advanced Chemical Engineering Principles.

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 techniques for determination of optimum process conditions for deterministic processes.

3.170G Process Principles

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

3.171G Corrosion Technology I

Theory of Corrosion—Principles: Thermodynamics, electrode kinetics. Applications: Predicting corrosion behaviour, corrosion prevention, corrosion rate measurements. *Industrial Corrosion:* Definitions—what it is. Terms used, units of measurement, corrosion research, corrosion technology, importance of corrosion (loss of product, downtime, safety, etc.). Extent—where it occurs. Cost. Economics. How it is prevented—materials selection, coatings, design, cathodic prevention, inhibitors.

Types of Corrosion: Direct chemical, galvanic, crevice, pitting, intergranular, phase attack, erosion—cavitation, stress, fatigue, hydrogen, fretting, atmospheric oxidation, high temperature oxidation. *Materials—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. Distilla-

tion 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

Evaluation of significant parameters. Experimental optimization techniques—multidimensional. Consideration of experimental error. Analytical optimization: (a) Consideration of modelling and simulation—mathematics only. (b) Linear programming—including: (i) applications to complete plants. (ii) partial optimization for non-linear processes. (c) Dynamic programming. (d) Discrete and continuous Maximum Principle.

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

A broad treatment of advanced theories of mass transfer including such topics as: interface instability, empirical and hydrodynamic models for the liquid phase; limitations of and extensions to the two resistance model used to predict contacting unit efficiency; gas absorption with chemical reaction; mass transfer in froths and foams.

3.186G Transport Phenomena

Basic concepts regarding the motion of heat and mass transfer from rigid and deformable particles in an infinite laminar fluid. The effects of acceleration, turbulence and shear flow fields on their motion. The study of single particles and bubbles will be extended to multiparticulate systems of both uniformly and heterogeneously sized particles, and the interaction between particles and bubbles.

3.187G Design

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 Chemical 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.

3.190G Specialist Lectures

DEPARTMENT OF FOOD TECHNOLOGY

3.201 Food Technology I

Introduction to food technology. Morphology, physiology and biochemistry of plants. Horticultural factors, maturity assessment, harvesting, precooling, packaging, transportation. Cold and CA storage, physiological disorders and their control.

TEXTBOOKS

Borgstrom, G. *Principles of Food Science.* 2 Vols. Macmillan, 1968.
Duckworth, R. B. *Fruit and Vegetables.* Pergamon, 1966.

REFERENCE BOOKS

Hulme, A. C. *The Biochemistry of Fruits and their Products.* 2 Vols., Academic, 1970.
Leopold, A. C. *Plant Growth and Development.* Academic, 1971.
Wareing, P. F. and I. D. J. Phillips. *The Control of Growth and Differentiation in Plants.*

3.211 Food Technology II

Introduction to food microbiology. Principles of preservation. Thermal processing, process evaluation. Dehydration and sun drying. Technology of frozen foods. Microbiology of canned, frozen and dehydrated foods, diagnosis of spoilage. Preservation by the use of salt, sugar and chemical preservatives. Juices, concentrates, non-alcoholic fermentations.

TEXTBOOKS

Frazier, W. C. *Food Microbiology.* McGraw-Hill, 1967.
Hersom, A. C., and Hulland, E. D. *Canned Foods: an Introduction to their Microbiology.* Churchill, 1969.

Williams, M. B. L. *Fundamentals of Thermal Bacteriology in Food Processing.* Record 7. Research and Productivity Council. Frederickton, 1969.
Duckworth, R. B. *Fruit and Vegetables.* Pergamon, 1966.
Earle, R. L. *Unit Operations in Food Processing.* Pergamon, 1966.

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 additives, food package requirements. Food spoilage, its diagnosis and control.

TEXTBOOKS

Frazier, W. C. *Food Microbiology.* 2nd ed. McGraw-Hill, 1967.
Knight, J. W. *The Starch Industry.* Pergamon, 1966.
Kent, N. L. *Technology of Cereals.* Pergamon, 1966.
Lawrie, R. A. *Meat Science.* Pergamon, 1966.

REFERENCE BOOKS

Please consult Department.

3.221 Food Technology IV

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

REFERENCE BOOKS (only)

Advances in Food Research. Vols. 1-18. Academic.
Amerine, M. A., and Joslyn, M. A. *Table Wines: the Technology of their Production.* Univ. of Calif., Berkeley, 1970.
Amerine, M. A. and Singleton, V. L. *Wines: an Introduction for Americans.* Univ. of Calif., Berkeley, 1968.
Furia, T. E. *C.R.C. Handbook of Food Additives.* Chemical Rubber Co., Cleveland, 1968.
Herschdoerfer, S. M. *Quality Control in the Food Industry.* 3 Vols. Academic, 1967-71.
Hobbs, B. C. *Food Poisoning and Food Hygeine.* 2nd ed. Arnold, 1968.
Imhoff, K., Muller, W. J., Thistlethwayte, D. K. B. *Disposal of Sewage and Water-Borne Wastes.* 2nd ed. Butterworth, 1970.
Mackinney, G., and Little, A. C. *Colour of Foods.* A.V.I., Westport, 1962.
Manual on Sensory Testing Methods. A.S.T.M. Special Technical Publication No. 434. A.S.T.M. Philadelphia, 1968.
Schultz, H. W., Day, E. A. and Libbey, C. M. *Symposium on Foods: Chemistry and Physiology of Flavours.* A.V.I., Westport, 1967.

3.231 Food Engineering I

Fluid flow and heat transfer — common with sections of the subject 3.111 Chemical Engineering I. A study of other unit operations relevant to food processing from the viewpoint of theory, equipment characteristics and materials of construction.

TEXTBOOKS

Earle, R. L. *Unit Operations in Food Processing.* Pergamon, 1966.
Brennan, J. G., Butters, J. R., Cowell, N. D. and Lilly, A. E. V. *Food Engineering Operations.* Elsevier, 1969.

3.232 Food Engineering II

Fundamental and applied aspects of engineering in selected food processing operations.

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 canning, freezing and dehydration technology with particular reference to unit processes and limiting parameters. Thermal processing and the evaluation of bacteriologically safe processes. Food spoilage, its diagnosis and control, foods in relation to disease. Food additives, food packaging. Food irradiation, freeze drying. Quality characteristics of foods, elements of human nutrition. Food regulations.

3.240 Food Technology Project (Chemical Engineering)

Project in Food Technology for students in Chemical Engineering.

3.250 Food Technology Report

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

3.241G Food Technology

World food supplies. Geographic considerations, sources and distribution. Structure and composition of foods, of plant and animal origin. Principles of food preservation. Food spoilage, chemical and microbiological, its nature and control. Foods in relation to disease. Food evaluation and acceptance, colour, flavour, texture and nutrition. Food regulations.

3.242G Treatment and Utilization of Biological Effluents

Origin, composition and disposal of wastes from biological, food and allied industries. Ecology of biological waste disposal in sewers, streams, ponds, beaches, absorption systems. Legal and economic aspects.

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., and Rogers, G. F. C. *Thermodynamic Properties of Fluids and Other Data.* Basil & Blackwell, Oxford, 1966.
Hickson, D. C., and Taylor, F. R. *Enthapy-Entropy Diagram for Steam.* Basil & Blackwell, Oxford.

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.

REFERENCE BOOKS

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

3.331 Fuel Engineering III

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

TEXTBOOKS

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.

REFERENCE BOOKS

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

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.

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.* Butterworth.
Nelson, W. *Petroleum Refinery Engineering.* McGraw-Hill.
Strauss, W. *Industrial Gas Cleaning.* Pergamon.
Norton, F. H. *Refractories.* McGraw-Hill.
Fristrom, R. M., and 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.

TEXTBOOK

Magill, P., Holden, A. & Ackley, C. *Air Pollution Handbook*. McGraw-Hill.

3.392G Fuel Science

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

TEXTBOOKS

As for 3.332.

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.*

Johnson, B. *Automatic Process Control.* McGraw-Hill.

McAdams, W. *Heat Transmission.* McGraw-Hill.

Shilling, S. *Process Dynamics and Control.* Holt, Rinehart & Winston.

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.

REFERENCE BOOKS

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

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

This subject will be presented as an elective in 1972.

3.440 Biological Process Engineering Project

Project in Biological Process Engineering for students in Chemical Engineering.

3.461G Physical Transport Processes

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

3.462G Thermodynamics and Theory of Rate Processes

Review of phenomenological, and introduction to statistical aspects. Thermodynamics of non-ideal solutions and macro molecules. Equilibria in complex reaction systems. Applications to biological systems. Metabolic and free radical energetics. Phenomenological characterization of reacting systems. Mathematical and experimental characterization of complex kinetic systems. Statistical treatment of interacting systems. Kinetic behaviour of non-stationary state systems. Reaction in condensed phases. Feedback mechanisms. Differential diffusion models; membrane transport mechanisms.

3.463G Bioprocess Dynamics and Plant Design

Linear systems, dynamics and control theory. Mathematical techniques. Computer applications. Introduction to non-linear systems. Problems of stability and applications to organic processes. Biochemical unit operations —process applications and engineering design. Special problems of design, materials and control introduced by aseptic requirements.

3.464G Continuous Culture Processes

Basic theory of the continuous cultivation of micro-organisms. Dynamics of continuous culture and its unsteady state characteristics. Models of cell growth, e.g., Monod model, variable yield model, unstructured and structured models, feedback control models. Multistage continuous culture. Use of batch data in design of multistage systems. Applications of continuous culture: (i) research tool; (ii) industrial fermentations; (iii) effluent treatment; (iv) microbiological oxidation of minerals. Engineering problems associated with continuous biological processes.

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 Chemical Plant, Design and Operation

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 Projects

SCHOOL OF METALLURGY

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 ion-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

Bennett, C. O. & Myers, J. E. *Momentum, Heat and Mass Transfer.* McGraw-Hill.
Cottrell, A. H. *An Introduction to Metallurgy.* Arnold.
Dennis, W. H. *Extractive Metallurgy.* Pitman.
Reed-Hill, R. E. *Physical Metallurgy Principles.* Van Nostrand.
Hume-Rothery, W. and Raynor, G. V. *The Structure of Metals and Alloys.* The Institute of Metals, London.

REFERENCE BOOKS

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.
Gensamer, M. *Strength of Materials under Combined Stress.* A.S.M.
Gilchrist, J. D. *Fuels and Refractories.* Pergamon.
Holloman, J. H. & Jaffe, L. D. *Ferrous Metallurgical Design.* Wiley.

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.
Phines, F. N. *Phase Diagrams in Metallurgy.* McGraw-Hill.
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

For the Mineral Processing section see under 7.311 Mineral Processing (School of Mining Engineering).

Barrett, C. S. *Structure of Metals.* 3rd ed. McGraw-Hill.
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.

4.012/1 Metallurgy IIA

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

4.012/2 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 4.012/1 is given by the School of Mining Engineering in 7.551 and 7.551/1. For Textbooks see p. 172.

TEXTBOOKS for 4.012/1 and 4.012/2

Barrett, C. S. *Structure of Metals.* 3rd ed., McGraw-Hill.
Cottrell, A. H. *The Mechanical Properties of Matter.* W.I.E.
Darken, L. S. & Gurry, R. W. *Physical Chemistry of Metals.* McGraw-Hill.
Hull, D. *Introduction to Dislocations.* Pergamon.
Mann, J. Y. *Fatigue of Materials.* M.U.P., 1967.
Swalin, R. A. *Thermodynamics of Solids.* Wiley.

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.* Butterworth.
Bodsworth, C. & Appleton, A. S. *Problems in Applied Thermodynamics.* Longmans.
Burkin, A. R. *Chemistry of Hydrometallurgical Processes.* Spon.
Campbell, I. E. *High Temperature Technology.* Wiley.
Clark, D. S. & Varney, W. R. *Physical Metallurgy for Engineers.* Van Nostrand.
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.
Hinsley, J. F. *Non-Destructive Testing.* Macdonald and Evans.
Hutchison, T. S. & Baird, D. C. *Physics of Engineering Solids.* 2nd ed. Wiley.
Hume-Rothery, W. *Atomic Theory for Students of Metallurgy.* Inst. of Metals, London.
Kondic, V. *Metallurgical Principles of Founding.* Arnold.
Kreith, F. *Principles of Heat Transfer.* Int. Textbook.
Levenspiel, O. *Chemical Reaction Engineering.* Wiley.
Read, W. T. *Dislocations in Crystals.* McGraw-Hill.
Sehuhmann, R. *Metallurgical Engineering.* Vol. 1. Addison-Wesley.
Seferian, O. *The Metallurgy of Welding.* Wiley.
Shewman, P. G. *Diffusion in Solids.* McGraw-Hill.
Shreir, L. L. ed. *Corrosion.* Vols. 1 and 2. Newnes.
Smallman, R. E. *Modern Physical Metallurgy.* Butterworth.
Tetelmann, A. S., McElivy, A. J. *The Fracture of Structural Materials.* Wiley.
Udin, H., Funk, E. R. & Wulff, J. *Welding for Engineers.* Wiley.
Wagner, C. *Thermodynamics of Alloys.* Addison-Wesley.
Zener, C. ed. *Thermodynamics of Physical Metallurgy.* A.S.M.

4.012/3 Metallurgy IIC

Principally industrial metallurgy, and substantially as for section (*i*) in 4.012/2.

4.012/4 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.

The section on "Mineral Processing" in 4.012 and 4.012/1 is given by the School of Mining Engineering in 7.551 and 7.551/1. For Textbooks see p. 172.

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.

REFERENCE BOOKS

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

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.* Inst. M.M., London.

4.013/1 Metallurgy Seminar

As specified in 4.013 Metallurgy III.

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. *10.351S Statistics* (see p. 183).

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.

4.901 Materials

An introductory course on the production, structure and properties of the main types of engineering materials, with a brief introduction to the process used in shaping and fabricating them. This course forms part of the subjects 5.001 Engineering I and 5.011 Engineering IA.

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 and II. Wiley.

REFERENCE BOOK
Guy, A. G. *Elements of Physical Metallurgy.* Addison-Wesley.

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. 4. Wiley.

REFERENCE BOOKS

Azaroff, L. V. & Brophy, J. J. *Electronic Processes in Materials.* McGraw-Hill.

Pfann, W. G. *Zone Melting.* 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.

TEXTBOOK

Guy, A. G. *Elements of Physical Metallurgy.* Addison-Wesley *or*

Hanks, R. W. *Materials Engineering Science.* Harcourt, Brace & World.

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.

SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING

5.001 Engineering I

TEXTBOOKS

A. *Introduction to Engineering*

Karbowiak, A., and Huey, R. M. *Information, Computers, Machines and Humans.* U.N.S.W. Press.

Harrisberger, L. *Engineeringsmanship.* Wadsworth.

or

Krick, E. V. *Introduction to Engineering and Engineering Design.* Wiley.

B. *Engineering Mechanics*

Meriam, J. L. *Statics.* Wiley.

C. *Engineering Drawing*

Robertson, R. G. *Descriptive Geometry.* Pitman.

Thomson, R. *Reading Exercises in Engineering Drawing.* Nelson.

5.311/5.301 Engineering Mechanics

TEXTBOOK

Meriam, J. L. *Dynamics.* Wiley, 1966.

5.331 Dynamics of Machines I

TEXTBOOK
Hirschhorn, J. *Dynamics of Machinery.* Nelson.

5.611 Fluid Mechanics/Thermodynamics

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

SCHOOL OF ELECTRICAL ENGINEERING

6.801 Electrical Engineering

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

6.841 Electronic Instrumentation

TEXTBOOK
No textbooks prescribed.

6.168G Potential and Systems Theory in Geophysics

TEXTBOOK
Lynch, W. A., and Truxal, J. G. *Signals and Systems.* McGraw-Hill.

SCHOOL OF MINING ENGINEERING

PRELIMINARY BACKGROUND READING
(Selected reading from this book list for First and Second Year Students.)
Blainey, G. *Mines in the Spinifex.* 1960.
Blainey, G. *The Peaks of Lyell.* A. & R.
Com. of Aus. *The Australian Mineral Industry Review 1966.* Bur. of Min. Res.
Farwell, G. M. *Down Argent Street.* Johnson.
Fox, A. F. *The World of Oil.* Pergamon.
Hoover, H. C. *The Memoirs of Herbert Hoover, 1874-1920 Years of Adventure.* Macmillan.
Lowering, T. S. *Minerals in World Affairs.* Prentice-Hall.
McLeod, I. R. *Australian Mineral Industry: The Mineral Deposits.* Bur. of Min. Res.
Morrell, W. P. *The Gold Rushes.* A. & C. Black.
Woodward, O. H. *A Review of the Broken Hill Lead, Silver & Zinc Industry.*

7.110 and 7.110/1 Mineral Resources

Part 1. Geological time scale, principles of mining, exploration, mine development, mine production, extension of operations. Salient data on the mineral industry, fuels, metals, industrial minerals. Mineral legislation, mining law, Government assistance and controls. Tutorial exercises.

Part 2. Investment, employment, wages, taxation, basic mining costs. International developments, pattern of mineral trade. Tutorial exercises.

TEXTBOOKS

Brown, D. A., Campbell, K. S. W. & Crook, K. A. W. *The Geological Evolution of Australia and New Zealand.* Pergamon.
Com. of Aust. *The Australian Mineral Industry Annual Review.* Bur. of Min. Res.
Fullard, H. *Atlas of the World.* E.U.P.
Lang, A. G. ed. *Manual of Australian Mining Laws.* Butterworth.

7.111 and 7.111/1 Mining Engineering I

Part 1. Development patterns and techniques for mineral deposits. Size and frequency of levels and other openings. Drilling equipment and techniques. Explosives, cratering and fracture of rock. Shaft sinking, layout, equipment and techniques. Tunnelling equipment and techniques. Mining applied to civil engineering projects.

Part 2. Advanced mining systems. Surface methods: metallic and non-metallic open cuts, dredging. Coal; horizon, room and pillar, longwall. Metals; stopes naturally supported, stopes artificially supported, caved stopes. Parameters for efficiency in mining techniques. Petroleum engineering; flow through porous media, reservoir engineering, primary and secondary recovery. Non-entry mining; leaching in situ salt, sulphur, underground gasification, offshore.

Part 3. Mechanical properties of rocks and soils. Failure theories.

TEXTBOOKS

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

7.112 Mining Engineering II

Part 1. Mine atmosphere, gas, dust, spontaneous combustion explosions, fires, mine rescue and recovery organisation. Mine ventilation properties of mine air fans, air flow, shock losses, thermodynamics. Transport of materials, flow of bulk solids, chute and storage design, conveyors, tracked and trackless transport, head frames, shaft conveyances, wire ropes, oil and slurry pipe lines. Natural state of stress in rock masses, stress concentration around underground openings.

Part 2. Support at the face, in roadways and in the waste. Power supply and transmission. Mine drainage, pumps, pump stations, flooding and dewatering. Mine safety engineering, health, hygiene, diseases. Noise Signalling. Principles of mine lighting. Compressed air generation and reticulation.

7.112/1 Mining Engineering II

For students in the B.Sc. (Eng.) course. Based on topics selected from the syllabuses of 7.112, 7.132 and 7.133.

7.113 Mineral Industry Elective Project

Elective may include mineral process engineering; statistics; sampling and valuation; rock mechanics, mine and treatment plant design, minerals and petroleum production engineering: selected courses from other schools. Students may be grouped in syndicates.

Part 1. Literature survey. *Part 2.* Thesis.

7.113/1 Mineral Industry Elective Project

For students in the B.Sc. (Tech.) and B.Sc. (Eng.) courses. Based on the syllabus of 7.113.

Part 1. Literature survey. *Part 2.* Thesis.

TEXTBOOKS

Barenburg, A. W. *Psychometry and Psychometric Charts.* S.Af.I.M.M.

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

Hartman, H. L. *Mine Ventilation and Air Conditioning.* Ronald Press.

Orbert, L. & Duvall, W. *Rock Mechanics and the Design of Structure in Rock.* Wiley, 1967.

Standards Association of Australia. *Steel Wire Rope for Winding and Haulage Purposes in Mines.* As No. M/4—1955.

7.115 Mining Engineering III

Explosives engineering, nuclear blasting. Petroleum engineering, offshore mining. Computer applications to mining methods and transport.

TEXTBOOK

Obert, L. & Ruvall, W. *Rock Mechanics and the Design of Structures in Rocks.* Wiley.

Woodruff, S. D. *Methods of Working Coal and Metal Mines.* Vols. 1 and 2, Pergamon, 1966.

7.116 Mining Engineering IV

Feasibility planning and mine design. Advanced mine ventilation, network analysis, refrigeration. Automation and mine control systems. Tectonics of non-entry methods of mining. Computer applications to mine planning, design of open pit excavations and underground structures in rock. Mechanics of mining subsidence.

TEXTBOOKS

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

Mero, M. *Mineral Resources of the Sea.* Pergamon.

7.121 Mine Surveying and Control Engineering

Surveying techniques in the development and exploitation of mineral resources and the assessment of mineral properties. Tunnel surveys, transfer of azimuth; bore hole surveying stope and ore reserve surveys, special mine surveys, mine survey office organization. Stereographic projection. Organization, programming and analysis of mining methods or techniques. Method of production control and grade control. Mathematical models of mining methods.

TEXTBOOK

Foxall, H. G. *Handbook for Practising Land and Engineering Surveyors.* The Inst. of Sur. Aust. N.S.W. Div.

7.121/1 Mine Surveying

For students in the B.Sc. (Eng.) course; based on the syllabus of 7.121.

TEXTBOOKS

Students should provide themselves with seven-figure logarithmic tables, such as Chambers' Mathematical Tables.

7.132 Mine Valuation

Sampling and valuation of mineral properties, administration. Resource allocation, finance, infrastructure, labour requirements.

TEXTBOOK

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

7.133 Mineral Economics

Scope of mining operations. Business cycles. Economics of the mineral industry. International statistics. Extractive processes and their influence on product control and allied minerals required. Management of mineral industry operations, company law.

TEXTBOOK

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

7.311 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.

7.311/1 Mineral Processing I

For students in the B.Sc. (Tech.) and B.Sc. (Eng.) courses. Based on the syllabus of 7.311.

TEXTBOOK

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

7.312 Mineral Processing IB

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.

TEXTBOOKS

Cameron, E. N. *Ore Microscopy*. Wiley.
Fuerstenau, O. W. ed. *50th Anniversary of Froth Flotation*. A.I.M.E. *or*
Gaudin, A. M. *Flotation*. 2nd ed. McGraw-Hill.
Taggart, A. F. *Handbook of Mineral Dressing*. Wiley.

7.315 Mineral Processing II

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

TEXTBOOKS

Cameron, E. N. *Ore Microscopy*. Wiley.
Gaudin, A. M. *Flotation*. 2nd ed. McGraw-Hill.

7.316 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.*
Fuerstenau, D. W. ed. *50th Anniversary of Froth Flotation*. A.I.M.E.
Leonard, J. W. & Mitchell, D. R. *Coal Preparation*. A.I.M.E.

7.411 Fluid Mechanics

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

7.412 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.

7.551 and 7.551/1 Mining and Mineral Process Engineering

Part 1. Mining Engineering. An introduction to mining engineering. Definitions and principles, types of mineral deposits, prospecting, mine and quarry development. Classification of mining methods, review of applications to coal, non-metallic and metalliferous deposits, petroleum production engineering and sea floor mining. Tutorial exercises and demonstrations.

Part 2. Mineral Process Engineering. Liberation, comminution, size analysis, gravity, magnetic, electrostatic separation. Froth flotation. Chemical extraction. Materials handling, dewatering. Process design, flow sheets. Mineral economics. Marketing of mineral products, smelter schedules. Tutorial exercises and demonstrations.

TEXTBOOKS

Gaudin, A. M. *Principles of Mineral Dressing*. McGraw-Hill.
Lewis, R. S. & Clark, G. B. *Elements of Mining*. Wiley.

MINING ENGINEERING GRADUATE SUBJECTS

7.191G Mining Engineering

I. Rock mechanics, behaviour and control of extraction openings in metalliferous, coal and non-entry mining. Techniques in deep mining.

II. Non-entry methods of mineral production, sub- surface horizons, conditioning of extraction horizon, fluid thermal and chemical factors.

TEXTBOOKS

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

Fox, A. F. *The World of Oil*. Pergamon.

Lewis, R. S. and Clark, G. B. *Elements of Mining*. Wiley.

Peele, R. *Mining Engineers Handbook*. 3rd edition. Vols. I and II. Wiley.

7.192G Mining Engineering Technology

I. Mine ventilation: mine atmosphere, quality and properties of mine air contaminants. Thermodynamics, network analyses. Application of analogues.

II. Materials handling: solids and liquids, analyses of control, application of programming techniques, power supply and distribution, legal and statutory requirements, protection of personnel and installations.

III. Economics: mineral-metal type complex, inter-industry economics of mineral production, resources allocation in mineral development programmes. Practical use of programming methods.

IV. Mine Design: separation of functions for maximum efficiency; application of analogue and digital computers. Explosives engineering (chemical and nuclear) applied to the mining industry.

TEXTBOOKS

As for 7.191G Mining Engineering.

7.193G Mining Engineering Laboratory

May include advanced work in: sampling and mine valuation: mine support (temporary or long terms): ventilation: mine design and plant (extraction areas and servicing functions): rock properties: programming of mining methods and transport: non-entry mining; petroleum engineering; gasification; solvent processes.

TEXTBOOKS

As for 7.191G. Mining Engineering.

MINERAL TECHNOLOGY GRADUATE SUBJECTS

7.391G Mineral Processing

Mineral economics: mineral processing and its integration with mining and metallurgical operations. Applied mineralogy, gravity separation processes, electrostatic and magnetic separation. Particle size distribution and analysis. Mathematical analysis of the technology of comminution.

TEXTBOOKS

Cameron, E. N. *Ore Microscopy*. Wiley.

Rose, H. E. and Sullivan, R. M. *Ball Tube and Rod Mills*. Constable.

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

7.392G Mineral Processing Technology, Parts 1 and 2

Surface chemistry of mineral particles, flotation, flocculation. Chemical processing and extraction. Fluid mechanics of particle and fluid systems, thickening classification. Material handling. Coal Preparation Technology, Process engineering, selection and design, flow sheets, plant design.

TEXTBOOKS

Arbiter, N. *Milling Methods in the Americas.* Gordon & Breach Sci. Pub.
Fuerstenau, D. W. ed. *50th Anniversary of Froth Flotation.*
or
Gaudin, A. M. *Flotation.* 2nd ed. McGraw-Hill.

7.393G 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 bearing fluids.

TEXTBOOK

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

SCHOOL OF CIVIL ENGINEERING

8.151 Mechanics of Solids

TEXTBOOK

Hall, A. S. *Introduction to Mechanics of Solids.* Wiley, 1968.

8.241 Geomechanics

Farmer, I. W. *Engineering Properties of Rocks.* Spon., 1968.
Terzaghi, K. & Peck, R. B. *Soil Mechanics in Engineering Practice.* 2nd ed., Wiley, 1967.

8.243 Soil Mechanics

TEXTBOOK

Lambe, T. W. & Whitman, R. V. *Soil Mechanics.* Wiley, 1969.
Terzaghi, K., and Peck, R. B. *Soil Mechanics in Engineering Practice.* 2nd ed. Wiley.

8.250 Properties of Materials

TEXTBOOK

Richards, C. W. *Engineering Materials Science.* Chapman & Hall.

8.510 Hydraulics

TEXTBOOKS

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

8.557G Hydrologic Investigations

TEXTBOOK

Linsley, R. K., Kohler, M. A., and Paulhus, J. L. *Applied Hydrology.* McGraw-Hill, 1958.

8.558G Groundwater Hydrology

TEXTBOOKS

De Weist, R. J. M. *Geo-hydrology*. Wiley, 1966.

Harr, M. E. *Groundwater and Seepage*. McGraw-Hill, 1962.

Marshall, T. *Relations between Water and Soil*. C'wealth Bureau of Soils, Harpenden, 1959.

Todd, D. K. *Groundwater Hydrology*. Wiley, 1959.

SCHOOL OF WOOL AND PASTORAL SCIENCES

9.101 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 determining the stratification of types. Sheep producing zones. Beef cattle in the sheep enterprise. Sheep breeds, their uses and economic relationships. Aids to judging. Crossbreeding for wool and/or meat production, prime lamb production.

Sheep management and calendar of operations; principal sources of wastage. Handling skins and hides.

9.122/1 Livestock Production IIA

Uses of cattle in the tropics and sub tropics. Adaptation of Bos indicus and B. taurus. Breeds of beef cattle and cross breeding, heterosis.

Types of beef cattle, enterprise, size of units and capital costs; herd composition. Starting the beef cattle enterprise, selection of breeding stock, and performance recording. Production of beef and veal, quality concepts.

Calendar of operations for beef breeding herds, and year round management, sale of stock.

9.122/2 Livestock Production IIB

The dairying and pig industries of Australia; patterns and trends. Principal breeds and their uses. Performance recording. Production of milk and milk by-products, and of pigmeats. Quality concepts of the various products.

Calendar of operations and the day to day management of the dairy cow; selection and management of the dairy sire.

Selection of breeding pigs; importance of type. Pig housing, management and feeding. Wastage and disease.

9.123 Livestock Production III

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.

TEXTBOOK for 9.101, 9.122 and 9.123.

Belschner, H. G. *Sheep Management and Diseases*. 8th ed. A. & R. 1971.

9.131 Animal Health and Preventive Medicine I—Animal Health

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—Animal Disease

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 intestina, large intestina, 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 and II. 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.

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.* S.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.

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.

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

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 IIA

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

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 IIB

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.

9.316 Analysis of Rural Development Projects

(To be offered from Session 1, 1972.)

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.
International Engineering Service Consortium. *An Economic Study of Keepit Dam.* Dept. of Conservation, Syd., 1970.
Isard, W. & Cumberland, J. H. eds. *Regional Economic Planning.* OEEC, Paris, 1961.
McKean, R. N. *Efficiency in Government Through Systems Analysis.* Wiley, 1958.
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.
Williams, D. B. ed. *Agriculture in the Australian Economy.* S.U.P., 1967.

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.* Butterworth, 1965.
Maynard, L. A. *Animal Nutrition.* McGraw-Hill, 1947.

9.531 Wool Technology I

Wool Study: The physical attributes of wool which on 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.

9.532/1 Wool Technology IIA

Wool Study: Practical wool sorting, wool classing and appraisal. Participation in the preparation of University Field Station and commercial wool clips. Wool valuing. The physical handling and the quality composition of the Australian clip.

9.532/2 Wool Technology IIB

Wool Metrology: Theories of sampling and measurement of wool characteristics. Laboratory procedures. Chemical and physical testing of raw wool. Estimation of wool damage.

9.532/3 Wool Technology IIC

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

9.533 Wool Technology III

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.

9.534 Wool Technology IV

Wool Science: Fine structure of the fibre, chemical composition, wool fibre physics, chemical reactivity, mechanical properties and developments in wool technology.

TEXTBOOKS

Henderson, A. E. *Growing Better Wool.* A. H. & A. W. Reed.

Onions, W. J. *Wool.* Benn, 1961.

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.

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.

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 for 9.601, 9.602 and 9.603.

Cole, H. H., and Cupps, P. T. eds. *Reproduction in Domestic Animals.* 2nd ed. Academic, 1969.

Sampson Wright. *Applied Physiology.* 10th ed. Oxford University Press, 1961.

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.

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 for 9.801 and 9.802.

Falconer, D. S. *Introduction to Quantitative Genetices.* Oliver & Boyd, 1960.

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

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.

9.821 Genetics

Applied genetics in relation to sheep improvement. Mendelian theory. Chromosomes and the physical basis of heredity. Crossing over, sex differentiation, multifactor inheritance in selection. Inbreeding. Introduction to population genetics. Heritability and correlation. Heterosis.

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.

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.

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

TEXTBOOKS

Blatt, J. M. *Introduction to Fortran IV Programming.* Prentice-Hall.

Kelly, G. M. *Introduction to Linear Algebra and Vector Geometry.* Reed Education, 1971.

Thomas, G. B. *Calculus and Analytic Geometry.* 4th ed. Addison-Wesley.

10.011 Higher Mathematics I

TEXTBOOKS

Blatt, J. M. *Introduction to Fortran IV Programming.* Prentice-Hall.

Fagg, S. V. *Differential Equations.* E.U.P.

Kelly, G. M. *Introduction to Linear Algebra and Vector Geometry.* Reed Education, 1971.

Spivak, M. *Calculus.* Benjamin.

10.021 Terminating Mathematics I

TEXTBOOKS

Blatt, J. M. *Introduction to Fortran IV Programming.* Prentice-Hall.

Notes on Sets, Probability, Matrices and Vectors. N.S.W.U.P.

10.022 Mathematics
10.031 Mathematics
10.032 Mathematics

TEXTBOOK

Kreyszig, E. *Advanced Engineering Mathematics.* Wiley.

10.033 Mathematics

TEXTBOOKS

Carslaw, H. S.. and Jaeger, J. C *Operational Methods in Applied Mathematics.* Dover.

Pipes, L. A. *Applied Mathematics for Engineers and Physicists.* 2nd ed. McGraw-Hill.

10.331 Statistics

TEXTBOOKS

Statistical Tables

Freund, J. E. *Mathematical Statistics.* 2nd ed. Prentice-Hall.

SCHOOL OF APPLIED PSYCHOLOGY

12.001 Psychology I

TEXTBOOKS

Part A—Theory

Morgan, C. T., & King, R. A. *Introduction to Psychology.* 4th ed. McGraw-Hill, 1971 *and*

Hebb, D. O. *Textbook of Psychology.* 2nd ed. Saunders, London, 1966. (Recommended as an additional textbook for intending Honours students.)

Part B—Practical
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.

13.112A Textile Technology 2A
13.112B Textile Technology 2B
13.112C Textile Technology 2C
13.112D Textile Technology 2D

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.

13.113A Textile Technology 3A
13.113B Textile Technology 3B
13.113C Textile Technology 3C
13.113D Textile Technology 3D

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 mech-

anisms. Needle selection for fabric decoration. Loop transfer for decoration and garment shaping. Hosiery manufacture. Multi-bar warp knitting. Laid-in fabrics. Raschel knitting. Stitch bonded fabrics. Basic garment assembly. *Part C. Dyeing and Finishing:* The production of specified dimensions in textile fabrics. The development of specific properties: mechanical, surface finishes, protective finishes.

13.211 Textile Science I

Production, properties and uses of textile fibres. Fibres, rubbers and plastics. Addition and condensation polymerisation. Chemical constitution and reactivity of the natural and man-made fibres. Optical microscopy and birefringence of fibres. Electron microscopy, X-ray diffraction and infrared absorption. Molecular and morphological structure of fibres, crystallinity and orientation of polymers. First and second order phase transitions. Relationship between molecular structure and mechanical properties of fibres.

TEXTBOOK
Peters, R. H. *Textile Chemistry*. Vol. 1. Elsevier, 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.

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.

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

14.111 Accounting I

TEXTBOOKS

Carrington, A. S., and Battersby, G. B. *Accounting—Concepts, Systems, Applications.* Australian ed. Whitcombe & Tombs, 1971.

Gordon, M. J., and Shillinglaw, G. *Accounting: A Management Approach.* 4th ed. Irwin, 1969.

Grouse, P. J. *An Introduction to Computer Programming in PL/1.* New College Publications, 1971.

Smyth, E. B. & Burke, W. L. *Introductory Accounting — A Managerial Emphasis.* Law Book Co., 1971.

14.321 Business Finance

TEXTBOOKS

Van Horne, J. C. *Financial Management and Policy.* 2nd ed. Prentice-Hall, 1971.

Robinson, R. G., and Johnson, R. W. *Self-Correcting Problems in Finance (Workbook).* 2nd ed. Allyn & Bacon, 1970.

SCHOOL OF ECONOMICS

15.101 Economics I

TEXTBOOKS

Australian National Accounts. 1971.

Lipsey, R. G. *An Introduction to Positive Economics.* 3rd ed. Weidenfeld & Nicolson, 1971.

Mansfield, E. *Microeconomics.* Norton, 1970.

Rowan, D. C. *Output, Inflation and Growth.* Macmillan, 1968.

Samuelson, P. A., Hancock, K., and Wallace, R. *Economics.* Aust. ed. McGraw-Hill, 1970.

Stilwell, J. A., and Lipsey, R. G. *Workbook to Accompany an Introduction to Positive Economics.* 2nd ed. Weidenfeld & Nicolson, 1971.

15.102 Economics II

TEXTBOOKS

Chamberlain, N. ed. *Contemporary Economic Issues.* Irwin, 1970.
Mansfield, E. *Microeconomics.* Norton, 1970.
Nevile, J. W. *Fiscal Policy in Australia.* Cheshire, 1970.
Nevile, J. W. & Stammer, D. W. eds. *Inflation and Unemployment.* Pelican, 1971.
Rowan, D. C. *Output Inflation and Growth.* Macmillan, 1968.
Runcie, N. *Australian Monetary and Fiscal Policy.* London Univ., 1971.
Runcie, N. *Economics of Instalment Credit.* London Univ. Press, 1969.
Spencer, M. H. *Managerial Economics.* 3rd ed. Irwin, 1968.

15.103 Economics III

TEXTBOOKS

Bhagwati, J. ed. *International Trade: Selected Readings.* Penguin, 1969.
Cooper, R. N. ed. *International Finance: Selected Readings.* Penguin, 1969.
McColl, G. D. ed. *Overseas Trade and Investment.* Pelican, 1971.
Meier, G. M. *The International Economics of Development: Theory and Policy.* Harper & Row, 1968.

15.243 Economic Development

TEXTBOOKS

Higgins, B. *Economic Development.* 3rd ed. Constable. London, 1968.
Lewis, W. A. *Development Planning.* Harper & Row, N.Y., 1966.
Meier, G. M. *The International Economics of Development.* Harper & Row, 1968.

15.263 International Economics

Not offered in 1972.

15.402 Econometric Methods

TEXTBOOK

Puckett, R. H. *Introduction to Mathematical Economics.* D. C. Heath, 1971.

BIOLOGICAL SCIENCES

17.001 General and Human Biology

TEXTBOOKS

Abercrombie, Hickman and Johnson. *A Dictionary of Biology.* Penguin.
Keeton, W. T. *Biological Science.* Norton, New York, 1967.
Kelly, P. J. ed. *Evidence and Deduction in Biological Science.* Penguin, 1970.

DEPARTMENT OF INDUSTRIAL ENGINEERING

18.121 Production Management

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 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.

18.551 Operations Research

TEXTBOOK

Hillier, F. S. & Lieberman, G. J. *Introduction to Operations Research.* Holden-Day, 1967.

SCHOOL OF CHEMICAL TECHNOLOGY

22.111 Industrial Chemistry I

(*a*) Review of services in the chemical industry.

(*b*) *Chemical Process Equipment*—The principles of operation, construction and fields of application of equipment used in carrying out various processes and operations in the chemical industry.

(*c*) *Instrumental Analysis*—Basic principles of volumetric and gravimetric analysis and the application of spectrometric equipment to the analysis of process streams.

22.112 Industrial Chemistry II

(*a*) *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 —fermentation, cellulose, acetylene, polymers, methanol and formaldehyde, sugar. (*b*) *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. (*c*) *Operations Research*—A study of the use of operations research in the chemical industry including linear programming, the transportation problem, inventory control techniques, applications of the queueing theory, use of the digital computer, brief discussion of network flow problems and dynamic programming. (*d*) *Chemical Thermodynamics and Kinetics*—(i) *Thermodynamics*—Statistical thermodynamics; thermodynamic functions; first and second laws of thermo-

dynamics; thermodynamics of fluids; power cycles; heterogeneous equilibrium; chemical reaction equilibrium; third law of thermodynamics; irreversible processes. (ii) *Kinetics*—Order of reaction and rate equations; theory of rate processes; diffusion; types of reactors; catalysis; mechanical arrangement of reactors for agitation and heat and mass transfer. (*e*) *Data Processing*—Application of the principles of statistics to chemical problems (Z test, t test, F test and x^2 test), analysis of variance, design of experiments, correlation and regression, quality control; use of graphical methods; fitting of empirical equations to experimental data; preparation of nomograms using constructional determinants. (*f*) *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.

22.112/1 and 22.112/2 Industrial Chemistry II—Parts 1 and 2

Part I is covered by sections (*a*) and (*f*) of 22.112 Industrial Chemistry II. Part II is covered by sections (*b*) to (*e*) inclusive of 22.112 Industrial Chemistry II.

22.112/1 Processes

TEXTBOOKS

Kent, J. A. *Riegel's Industrial Chemistry*. Reinhold. *or*
Shreve, R. N. *Chemical Process Industries*. McGraw-Hill.

22.112/2

TEXTBOOKS

Chemical Thermodynamics and Kinetics

Smith, J. M. *Chemical Engineering Kinetics*. McGraw-Hill.

Smith, J. M., and Van Ness, H. C. *Introduction to Chemical Engineering Kinetics*. McGraw-Hill.

Smith, N. O. *Chemical Thermodynamics—A Problems Approach*. Reinhold.

Data Processing

Crow, E. L. Davis, F. A., and Maxfield, M. W. *Statistics Manual*. Dover.

22.113 Industrial Chemistry III

(*a*) *Processes*. Topics selected from the following will be studied in depth: refractories, high-temperature processes, high-pressure processes (especially ammonia synthesis—thermodynamics and equipment), high-vacuum processes, nuclear metals, industrial polymers, aromatic intermediates, fermentation industries. (*b*) *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. (*c*) *Advanced Kinetics*. Theoretical kinetics (rate processes, statistical mechanics, diffusion), catalysis, solid-state reactions, polymerization kinetics scale-up reactor design, applications of computers to kinetics and reactor design, nuclear reactions. (*d*) *Process Simulation*. The application of the hybrid computer to the study of the dynamics of processes encountered in the chemical industry.

TEXTBOOK

Johnson, E. F. *Automatic Process Control*. McGraw-Hill.

22.121 Industrial Chemistry 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, critical evaluation, and logical presentation of information. Opportunity will be taken, where appropriate, to arrange for guest lecturers .

22.131 Industrial Chemistry (Processes)

For the description of this subject see section (*a*) Processes, of 22.112 Industrial Chemistry II. Students are also required to take part in a series of factory visits and prepare reports on them.

22.211 Ceramics I

Ceramics Ia—Introduction; basic principles of firing procedures (thermodynamics, phase equilibria, reaction rates, nucleation and growth of phases), fired properties and the quality control of finished products; stoichiometry; calculation of the physical properties of ceramic materials. *Ceramics Ib*—Chemical Ceramics—Structural principles; crystal chemistry; kinetics of solid-state reactions; chemistry of ceramics in relation to the periodic table. A systematic treatment of a range of ceramic products in the light of the above principles. *Ceramic Equipment*—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.

TEXTBOOKS

Ford, W. F. *Institute of Ceramics Text Book Series, 4: Effect of Heat on Ceramics.* Maclaren, 1967.

Griffiths, R. & Radford, C. *Calculations in Ceramics.* Maclaren, 1965.

Worrall, W. E. *Institute of Ceramics Text Book Series, 1: Raw Materials.* Maclaren, 1964.

22.211/1 and 22.211/2 Ceramics I—Parts 1 and 2

22.211 Ceramics I for part-time students in two parts over two years.

22.212 Ceramics II

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. *Fuel Technology*—The nature of solid, liquid and gaseous fuels; principles of combustion. *Laboratory.*

TEXTBOOK

Kingery, W. D. *Introduction to Ceramics.* Wiley.

22.221 Chemical Thermodynamics and Kinetics

For the description of this subject, see section (*d*), Chemical Thermodynamics and Kinetics, of 22.112 Industrial Chemistry II.

22.231 Ceramic Engineering

A detailed study of the mechanical properties of ceramic materials and a comparison of these with those of metals and plastics. A detailed fundamental treatment of the unit operations concerned with the handling of ceramic materials; production of high temperatures; unsteady-state heat transfer and firing. Ceramic engineering design.

22.241 Instrumentation and Process Control

For the description of this subject, see section (*b*), Instrumentation and Process Control, of 22.113 Industrial Chemistry III.

22.251 Operations Research and Seminars

For the description of this subject, see section (*c*), Operations Research, of 22.112 Industrial Chemistry II.

22.311 Polymer Science I

(*a*) *Organic Process Chemistry of Polymers.* Session 1.

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.

(*b*) *Polymer Characterization.* Session 2.

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.

(*c*) *Polymer Physics.* Session 1.

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.

(*d*) Laboratory 4 hrs./week for the whole year.

Selected experiments illustrating principles developed in the lecture courses in polymer physics and polymer chemistry.

TEXTBOOKS

Allen, P. W. ed. *Techniques of Polymer Characterisation.* Butterworth.

Margerison, D., and East, G. C. *Introduction to Polymer Chemistry.* Pergamon.

Schmidt, A. X., and Marlies, C. A. *Principles of High Polymers—Theory & Practice.* McGraw-Hill.

22.312 Polymer Science II

This subject is divided into two parts, Part A dealing with polymer chemistry and Part B with polymer physics. Parts A and B are scheduled as 2 hour/week lecture courses in Sessions 1 and 2 respectively. Students may elect to study either or both parts.

Part A: A detailed study of topics selected from the following:—Structure/property relationships, inorganic polymers, polymers for high temperature service, acrylate esters, gas chromatography in polymer science, medical use of polymers, permeability of films, surface coatings.

Part B: A detailed study of topics selected from the following:—Rubber elasticity, extrusion plastometry, rheological aspects of polymer processing operations.

TEXTBOOK

Schmidt, A. X., and Marlies, C. A. *Principles of High-Polymers—Theory & Practice.* McGraw-Hill.

POLYMER TECHNOLOGY GRADUATE SUBJECTS

22.321G 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: extrustion fundamentals (screw type)—isothermal operation, adiabatic operation, die design; ram extrusion fundamentals; screwless extrusion fundamentals; injection moulding (plastic 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 (1⅛" extruder); screw extrusion of elastomers (1¼" extruder); screwless extrusion of thermoplastics; vacuum forming from sheet material; hot gas welding of thermoplastics; hot sealing of plastic films.

TEXTBOOKS

Billmeyer, F. W. *Textbook of Polymer Science.* Wiley. *or*
Schildknecht, C. A. *Vinyl and Related Polymers.* Wiley.
Schmidt, A. X., and Marlies, C. A. *Principles of High Polymers—Theory & Practice.* McGraw-Hill.

22.322G Polymer Engineering II

(*a*) *Polymer Physical Properties and Engineering Applications of Polymers*—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.

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*—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; refractive index extrusion plastometry; cone and plate viscometry (solid polymers).

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.

22.331G Polymer Chemistry I

(*a*) *Organic Process Chemistry:* Natural Polymers—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.

(b) 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.

(*c*) *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.

(*d*) *Laboratory*—Selected experiments illustrating principles developed in lectures.

TEXTBOOKS

Allen, P. W. ed. *Techniques of Polymer Characterisation.* Butterworth.
Flory, P. J. *Principles of Polymer Chemistry.* Cornell U.P.
Lenz, R. W. *Organic Chemistry of Synthetic High Polymers.* Wiley.
Margerison, D., and East, G. C. *Introduction to Polymer Chemistry.* Pergamon.

22.332G Polymer Chemistry II

(*a*) *Polymer Structure and Properties:* (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 applications of plastics; choice and design of materials for specific applications; (ii) *Degradation*—thermal, photolytic, mechanical, ultrasonic, radiation damage, oxidative, model compounds; biological degradation; protection of materials against degradation.

(*b*) *Inorganic Polymers:* polymers containing backbones other than carbon: phosphorus, arsenic, sulphur; polysilicanes.

(*c*) *Analysis:* instrumental methods, U.V. and I.R. spectroscopy, endgroup analysis, vapour phase chromatography; degradation; X-rays, radioisotopes; stereoisomers, chemical methods.

(*d*) *Laboratory*—Selected experiments illustrating principles developed in lectures.

TEXTBOOK

Sharples, A. *Introduction to Polymer Crystallization.* Arnold.

SCHOOL OF APPLIED GEOLOGY

25.001 Geology I

Physical Geology—The 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. Introductory physiography.

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.

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 description of examples of important fossil groups. Supplemented by three field tutorials, attendance at which is compulsory.

TEXTBOOKS

Holmes, A. *Principles of Physical Geology.* N.A.P. *or*
Longwell, C. R. & Flint, R. F. *Introduction to Physical Geology.* Wiley.
Rutley, F. *Elements of Mineralogy.* Ed. H. H. Read. Murby, London.

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, macroscopic—mesoscopic structures, stereographic projection for studies of mesoscopic structures, structural-analysis of folded rocks, faults and joints. Introduction to microscopic structures-petrofabrics. Experimental structural geology. Practical: Stereographic applications — Wulff net, Schmidt net. Introduction to structural analysis, fault problems.

Field Work: Approximately fourteen days will be spent on field tutorial throughout the year. Attendance is compulsory.

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 I

Williams, H., Turner, F. J. & Gilbert, C. M. *Petrography.* Freeman, 1954.

Winkler, H. G. F. *Petrogenesis of Metamorphic Rocks.* 2nd ed. Springer, 1967.

Palaeontology I

Moore, R. C., Lalicker, C. G. & Fischer, A. G. *Invertebrate Fossils.* McGraw-Hill, 1952.

Stratigraphy I

Dunbar, C. O. & Rodgers, J. *Principles of Stratigraphy.* Wiley, 1957.

Structural Geology

Spencer, E. W. *Introduction to the Structure of the Earth.* McGraw-Hill, 1969.

Ragan, D. M. *Structural Geology—An Introduction to Geometrical Techniques.* Wiley, 1968.

25.003/1, 25.003/2 Geology III, Parts I and II

Part I

Stratigraphy and Sedimentation—Advanced stratigraphic principals and techniques. Evolution of geosynclines and intracratonic basins. Regional stratigraphy and basin analysis. The sedimentational and tectonic history of selected geological provinces in Australia. The theory of continental drift and its stratigraphic implications.

Mineralogy—Optical theory of biaxial crystals, optical dispersion. An introduction to the theory of the Universal Stage. Selected topics in crystal chemistry. The nature of X-ray diffraction, theory and interpretation of X-ray powder and single crystal photographs. *Practical:* Determination of optical constants, use of immersion media for refractive index determination. Use of Universal Stage. Construction of a simple crystal structure model. Preparation and interpretation of X-ray powder and single crystal photographs.

Petrology—Sedimentary Petrology—The influence of transportation, deposition and diagenesis on the composition, texture and structure of the sedimentary rocks. Chemical weathering. The classification of detrital sediments. The non-clastic sediments. *Igneous Petrology*—Magma types and differentiation trends. *Metamorphic Petrology*—Metamorphic zones and metamorphic facies. *Practical:* Micro-petrography. Techniques of sedimentary petrology.

Part II

Geophysics—Physics, shape, structure and constitution of the earth; geotectonics, seismology, gravity, geodesy, geothermy, geomagnetism, palaeomagnetism, geoelectricity, aeronomy and geochronology. Practical work includes a one day field tutorial.

Palaeontology—Applications of palaeontology to stratigraphy (geochronology and palaeoecology). Vertebrate palaeontology.

Structural Geology—Diastrophic and non-diastrophic deformations and dislocations; structures associated with igneous rocks; alpine style tectonics. Geotectonics. An introduction to structural analysis. *Practical:* Advanced structural mapping; structural problems, including use of the stereographic net.

Economic Geology—Principles and theories of ore deposition; ore magmas—synmagmatic, epimagmatic and post-magmatic processes. Submarine exhalative deposits. Sedimentary biogenetic deposits. Alluvial and residual deposits. Non-metallic ores. *Practical:* Macroscopic study of ores and country rock. Study of ores and associated rocks in thin and polished section.

Field work—will be held during the year. This includes a geological survey camp which will be held before the first term, and ten days of field instruction. Attendance is compulsory.

TEXTBOOKS

Stratigraphy II

Krumbein, W. C., and Sloss, L. L. *Stratigraphy and Sedimentation.* 2nd ed. Freeman, 1963.

Stratigraphical Palaeontology

Colbert, E. H. *Evolution of the Vertebrates.* Wiley.

Von Koenigswald, G. H. R. *The Evolution of Man.* Univ. of Michigan, 1962.

Structural Geology

Hills, E. S. *Elements of Structural Geology.* Methuen, 1963.

Phillips, F. C. *Use of Stereographic Projection in Structural Geology.* Arnold, 1960.

Geophysics

Garland, G. D. *The Earth's Shape and Gravity.* Pergamon, 1964.

Howell, B. *Introduction to Geophysics.* McGraw-Hill, 1959.

Stacey, F. P. *Physics of the Earth.* Wiley, 1969.

Petrology II

Deer, W. A., Howie, R. A., and Zussman, J. *Rock Forming Minerals.* Longmans, 1966.

Turner, F. J., and Verhoogen, J. *Igneous and Metamorphic Petrology.* McGraw-Hill, 1960.

Minerology

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.

Economic Geology

Park, C. F., and MacDiarmid, R. A. *Ore Deposits.* Freeman, 1964.

25.004/1, 25.004/2, 25.004/3, 25.004/4 and 25.004/5 Geology IV, Parts I, II, III, IV and V

Part I

Engineering Geology—An introduction to rock mechanics. The strength, deformability, permeability and chemical stability of rocks. Discontinuities in rock masses. Mass movement and stabilty of slopes. An introduction to hydrogeology. The application of geology to engineering practice. A compulsory field tutorial which includes inspection of civil engineering projects.

Part II

Exploration Geophysics—The theory, interpretation and practice of geophysical methods in exploration, including and extending beyond 25.013 Geology III (Supplementary) *Exploration Geophysics.*

Part III

Exploration and Mining Geology—Selection of prospecting areas, methods of mineral search, assessment of new discoveries and subsequent development as underground or open cut mines, re-evaluation of old mines. The work of a geologist in operating mines, ore prediction, exploratory drilling. Evaluation of coalfields. Mine geology of leading Australian mines. *Laboratory:* Solution of mining geology problems involving drill core assays and developmental procedures. Exercises in geochemical prospecting.

Petroleum Engineering—Chemistry of drilling fluids, design of casing strings. Reservoir assessment and computation of reserves. Petroleum production techniques, artificial lift and secondary recovery methods. Drill stem testing, reservoir stimulation techniques including acidising, hydraulic fracturing. Controlled directional drilling.

Part IV

Engineering Surveying—Ordinary levelling, angle measurements, linear measurements (tapes), theodolite traversing, tacheometry, areas and volumes, contour and detail surveys.

Part V

Project.

TEXTBOOKS

Mining and Petroleum Geology

Lawrence, L. J. ed. *Exploration and Mining Geology*. Aus. I.M.M. Melbourne, 1965.

Geophysics

Dobrin, N. B. *Introduction to Geophysical Prospecting*. McGraw-Hill, 1960.

Grant, F. S., and West, G. F. *Interpretation Theory in Applied Geophysics*. McGraw-Hill, 1964.

Parasnis, D. S. *Principles of Applied Geophysics*. Methuen, 1962.

25.013 Geology III (Supplementary)

Consists of section (*a*) and two components of section (*b*) approved by Head of School.

Section (a)

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.

Photogeology—The principles of photogeology and photo-interpretation of laboratory work to illustrate the lecture course.

Geophysics—The theory, interpretation and practice of geophysical methods in exploration. Seismic, electrical, electromagnetic, gravity, magnetic, radioactive and well logging. Applications in hydrology, engineering, petroleum and mining geophysics. Laboratory requirements, include conducting model experiments illustrating the different field methods.

Coal—Origin and distribution of coals. Coal type and coal rank. Petrology of coal and coal analyses.

Oil—Occurrence of oil. Recovery techniques and reservoir assessment.

Geochemistry—The geochemical distribution of elements and the geochemical cycle. Isotope geology. Mineral thermodynamics and phase equilibria. Meteorites. Geochemical prospecting. The clay minerals and their properties. Surface chemistry of clays. Chemical weathering. The geochemistry of the common rock-forming elements.

Section (b)

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.

Stratigraphy and Sedimentology—Detailed study of the sedimentological features of deltaic, shallow marine and aeolian sediments, and of turbidites. Environmental analysis of sedimentary sequences. Methods of sediment analysis and sediment parameters. Laboratory flume experiments. Photogeology. Stratigraphic maps. Selected stratigraphic topics.

Palaeontology—Micropalaeontology—the morphology, taxonomy and stratigraphical distribution of the principal groups of microfossils. *Practical work*—Study and description of foraminifera, ostracoda, conodonts and plant microfossils, also certain examples of megafossils from the invertebrate phyla. Micropalaeontological techniques.

Structural Analysis—The geometric analysis, on all scales, of the fabric of metamorphic tectonites; the kinematic and dynamic inferences that may be made. Strain markers and the problems associated with strain analysis. Genesis of selected fabric elements (including preferred crystal lattice orientations) based on experimental work. *Practical work*—Geometric analysis of hand specimens; elucidation of the geometric properties of superposed fabric elements; interpretation and presentation of structural data, leading to the construction of orthographic block diagrams. The universal stage as a tool in microscopic analysis. *Field work*—Approximately ten days will be spent on field tutorials.

TEXTBOOKS

Oceanography

Pickard, G. L. *Descriptive Physical Oceanography.* Pergamon, 1964.

Geophysics II

Dobrin, M. B. *Introduction to Geophysical Prospecting.* McGraw-Hill, 1960.

Parasnis, D. S. *Principles of Applied Geophysics.* Methuen, 1962.

Coal

Raistrick, H., and Marshall, C. E. *The Nature and Origin of Coal and Coal Seams.* E.U.P. 1952

Oil

Levorsen, A. I. *Petroleum Geology.* Freeman, 1954.

Geochemistry

Ahrens, L. H. *Distribution of the Elements in our Planet.* McGraw-Hill.

Fyfe, W. S. *Geochemistry of Solids.* McGraw-Hill, 1964.

Loughnan, F. C. *Chemical Weathering of Silicate Minerals.* American Elsevier.

Mason, B. *Principles of Geochemistry.* 2nd ed. Wiley.

Siegel, S. *Nonparametric Statistics for the Behavioral Sciences.* McGraw-Hill, 1956.

Zussman, J. ed. *Physical Methods in Determinative Mineralogy.* Academic, London, 1967.

Mineragraphy

Edwards, A. B. *Textures of the Ore Minerals.* 2nd ed. Aus. I.M.M., 1954.

Hallimond, A. F. *1953 Manual of the Polarizing Microscope.* Cooke.

Uytenbogaardt, W. *Tables for Microscopic Identification of Ore Minerals.* Princeton U.P.

Stratigraphy III

See list for Stratigraphy II (25.003).

Micropalaeontology

Glaessner, M. F. *Principles of Micropalaeontology.* M.U.P., 1955. Hafner reprint ed. 1963.

Structural Analysis

Turner, F. J., and Weiss, L. E. *Structural Analysis of Metamorphic Tectonites.* McGraw-Hill, 1963.

25.101 Geology for Engineers

An introduction to geology with emphasis on the mechanical properties of rock and soil. Rock-forming minerals, clay minerals and the classification of rocks. The properties of rock. An introduction to the processes of orogenesis, epeirogenesis, denudation and weathering of rocks, vulcanicity, intrusion of plutonic rocks, sedimentation and metamorphism. Groundwater, the formation of soils, landforms and the stability of slopes. Review of the application of geology and geophysics in engineering practice. Laboratory work consists of the examination and the identification of common rock-forming minerals and rock types, and the preparation and interpretation of simple geological maps and sections. Two geological field tutorials of one day duration are a compulsory part of the course, and satisfactory field tutorial reports are to be submitted.

TEXTBOOK

Blyth, F. G. *Geology for Engineers.* 4th ed. 1960.

25.102 Geology for Mining Engineers

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 25.004/3, 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.

25.102/1 Geology for Mining Engineers (B.Sc.(Tech.))

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.

25.201 Mineralogy (Metallurgy Course)

The crystalline state of minerals; fundamental laws of crystallography, symmetry elements and symmetry operations; crystal systems and classes; Miller indices; stereographic projection of crystals. Examples of the more common crystal classes. Regular and irregular attachment of crystals, twin-

ning, etc.; crystal growth and its anomalies. Fundamentals of the atomic structure of crystals; Bravais lattices; examples of the atomic structure of some common minerals. Physical properties of crystals; cleavage, gliding, secondary twinning, elasticity. Elements of crystal optics in polarized light. Mode of formation of minerals and ores in the igneous, sedimentary and metamorphic cycles; introduction to petrology. Principal types of economic mineral deposits. Elements of fuel geology; construction and refractory materials. Classification of minerals. Descriptive mineralogy of common minerals, especially economic minerals. *Laboratory: Crystallography*—Examination of crystals and crystal models for symmetry; perspective drawing of crystal models. *Optical Mineralogy*—Examination of minerals by means of the polarizing microscope in transmitted and incident, reflected light. Determination of the refractive indices of crystal fragments by means of the immersion method. *Descriptive and Determinative Mineralogy*—Macroscopic examination of common minerals, especially economic minerals; study of the paragenesis and mode of occurrence of common mineral groups. Study of 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. Read, H. H. Murby, London.

APPLIED GEOLOGY GRADUATE SUBJECTS

25.111G Geology

A series of special courses in aspects of geology which have particular relevance to geophysics: structural geology, stratigraphy, petroleum geology, engineering geology, petrology, economic mineralogy, geochemistry, air-photo interpretation and field methods.

25.321G Geophysics

The physics, shape, structure and constitution of the earth. Extensive treatment of the theory, interpretation, instrumentation, practice and applications of geophysical methods in exploration: seismic, electric, electromagnetic, gravity, magnetic, radioactive and well logging. Laboratory requirements include projects in model experimentation, and field requirements include three weeks ot field tutorials on the practice of geophysical methods.

TEXTBOOKS

Grant, F. S., and West, G. F. *Interpretation Theory in Applied Geophysics*. McGraw-Hill, 1965.

Keller, H. B., and Frischkenect, F. C. *Electrical Methods in Geophysical Prospecting*. Pergamon, 1966.

25.401G Ground Water Investigations

Geological factors influencing the occurrence of groundwater, role of structural and physical geology in groundwater studies, influence of rocks on groundwater quality. Exploration, evaluation and development of groundwater, well-logging techniques. Groundwater problems in semi-arid and arid zones. Groundwater geophysics, geophysics applied to groundwater exploration and assessment, geophysical methods utilized in well-logging. Drilling equipment and well development. Hydrogeologic maps and their interpretation. Field tutorials will be conducted.

TEXTBOOK
Davis, S. N., and De Wiest, R. J. *Hydrogeology*. Wiley, 1966.

25.402G Hydrogeology

The exploration and evaluation of groundwater, borehole samples and geological well-logging techniques, geological factors influencing the occurrence of groundwater, preparation of hydrogeologic maps. Further studies in arid zone geohydrology. Practical work will cover the preparation of hydrogeologic maps, the classification of borehole samples and the evaluation of the water balance. Field tutorials will be included.

TEXTBOOK
Davis, S. N., and De Wiest, R. J. *Hydrogeology*. Wiley, 1966.

25.403G Project (Hydrogeology Graduate Course)

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 NUCLEAR ENGINEERING

23.051 Nuclear Power Technology

(An option for 4th year Chemical Engineering Undergraduates in 1972.)

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.

SCHOOL OF GEOGRAPHY

27.001 Applied Geography I

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. 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 airphotos. Elementary map-making. Methods of describing soils, vegetation and land systems.

The course includes three compulsory one-day field tutorials.

TEXTBOOKS

Barry, R. G., and Chorley, R. J. *Atmosphere, Water and Climate.* Methuen.
Corbett, J. R. *The Living Soil.* Martindale Press.
CSIRO. *The Australian Environment.* M.U.P.
Twidale, C. R. *Geomorphology.* Nelson. Paperback.

REFERENCE BOOKS

Chorley, R. J. ed. *Water, Earth and Man.* Methuen.
Commonwealth Bureau of Meteorology. *Manual of Meteorology.* Govt. Printer.
Daubenmire, R. F. *Plants and Environment.* Wiley.
Daubenmire, R. F. *Plant Communities.* Harper & Rowe.
Gentilli, J. *Sun, Climate and Life.* Jacaranda.
Hare, K. F. *The Restless Atmosphere.* Hutchinson.
Leeper, G. W. *Introduction to Soil Science.* M.U.P.
Lueder, D. R. *Aerial Photographic Interpretation, Principles and Applications.* McGraw-Hill.
Odum, E. P. *Ecology.* Holt, Rinehart & Winston.
Pettersen, S. *Introduction to Meteorology.* McGraw-Hill.
Riehl, H. *Introduction to the Atmosphere.* McGraw-Hill.
Riley, D., and Young, A. *World Vegetation.* C.U.P.
Shields, A. J. *Australian Weather.* Jacaranda.
Stace, H. C. T. *A Handbook of Australian Soils.* Rellim.
Strahler, A. N. *Physical Geography.* Wiley.
Thornbury, W. D. *Principles of Geomorphology.* Wiley.
Tweedie, A. D. *Water and the World.* Nelson.

27.002 Applied Geography II

Part I (Session 1). *Introduction to Economic Geography:* The geographic problems of scale and distance. The relevance of theory and quantitative methods. Patterns and structures of systems of agriculture, manufacturing and tertiary production in under-developed and advanced societies. Origins and functioning of the settlement network of central places and connecting routes. Includes an urban field tutorial of one day. Laboratory classes consist of the application of statistical methods to areal and point data.

TEXTBOOKS

Cole, J. P. & King, C. A. M. *Quantitative Geography.* Wiley.
Morrill, R. L. *The Spatial Organisation of Society.* Wadsworth.

REFERENCE BOOKS

Abler, R., Adams, J. S. & Gould, P. *Spatial Organisation.* Prentice-Hall.
Broek, J. O. M. *Geography: Its Scope and Spirit.* Merrill. Paperback.
Chisholm, M. *Rural Settlement and Land Use.* Hutchinson.

Dohrs, F. E. & Sommers, L. M. eds. *Introduction to Geography: Selected Readings*. Crowell. Paperback.
Estall, R. C., & Buchanan, R. O. *Industrial Activity and Economic Geography*. Hutchinson.
McCarty, H. H., & Lindberg, J. B. *A Preface to Economic Geography*. Prentice-Hall.
Mayer, H. H., & Kohn, C. F. eds. *Readings in Urban Geography*. Chicago U.P.
Mountjoy, A. B. *Industrialisation and Underdeveloped Countries*. Hutchinson.
Rose, A. J. *Patterns of Cities*. Nelson.
Rutherford, J., Logan, M. I. & Missen, G. I. *New Viewpoints in Economic Geography*. Martindale.
Taaffe, E. J. *Geography*. Prentice-Hall. Paperback.

Part II (Session 2). *Geographic Models*. Aims and methods of enquiry as a basis for discerning pattern and order in the economic and social landscape. Emphasis on locational models which attempt to explain the pattern and structure of urban settlement and transportation routes. Introduction to elements of population geography. A compulsory field tutorial of up to three days to study an urban complex.

TEXTBOOK

Haggett, P. *Locational Analysis in Human Geography*. Arnold.

REFERENCE BOOKS

Abler, R., Adams, J. S. & Gould, P. *Spatial Organisation*. Prentice-Hall.
Berry, B. *Geography of Market Centres and Retail Distribution*. Prentice-Hall.
Berry, B. & Houghton, F. E. *Geographic Perspectives on Urban Systems*. Prentice-Hall.
Chapin, F. S. *Urban Land Use Planning*. Illinois U.P.
Clarke, J. I. *Population Geography*. Pergamon.
Clarke, J. I. *Population Geography and the Developing Countries*. Pergamon.
Haggett, P., & Chorley, R. eds. *Integrated Models in Geography*. Methuen. Paperback.
Haggett, P., & Chorley, R. eds. *Socio-economic Models in Geography*. Methuen.
Johnson, J. H. *Urban Geography*. Pergamon.
Rose, A. J. *Patterns of Cities*. Nelson.
Zelinsky, W. *A Prologue to Population Geography*. Prentice-Hall.

Part III. Laboratory classes throughout the year dealing with the application of statistical methods to geographic data. Descriptive statistics, sampling techniques, elementary probability, correlation, regression, significance-testing, and an introduction to nonparametric statistics.

TEXTBOOKS

Yeomans, K. A. *Introductory Statistics: Statistics for the Social Scientist*. Vol. I. Penguin. Paperback.
Yeomans, K. A. *Applied Statistics: Statistics for the Social Scientist*. Vol. II. Penguin. Paperback.

REFERENCE BOOKS

Cole, J. P., & King, C. A. *Quantitative Geography*. Wiley.
Dixon, N. J., & Massey, F. J. *Introduction to Statistical Analysis*. McGraw-Hill.
Kalton, G. *Introduction to Statistical Ideas*. Chapman & Hall.
King, L. J. *Statistical Analysis in Geography*. Prentice-Hall.
Moroney, M. J. *Facts from Figures*. Pelican.

This course includes two compulsory field tutorials, one of one day and one of three days' duration. These will involve study of the structure and function of an urban and/or industrial complex and its impact on the adjacent agricultural area.

27.013 Geographic Methods

Classes throughout the year dealing with methods and the interpretation of geographic data; research design, data sources, field methods; collection, classification, and analysis of data, stressing multivariate techniques and computer library programs. Complements all third-year Geography options. Up to five days' field tutorials involving studies related to the options listed above.

TEXTBOOKS

Veldman, D. J. *Fortran Programming for Behavioural Sciences.* Holt, Rinehart & Winston.

REFERENCE BOOKS

Cole, J. P. & King, C. A. M. *Quantitative Geography.* Wiley.

Dixon, W. J. & Massey, F. J. *Introduction to Statistical Analysis.* McGraw-Hill. Paperback.

Jackson, J. N. *Surveys for Town and Country Planning.* Hutchinson. Paperback.

Kerlinger, R. *Foundations of Behavioural Research.* Holt, Rinehart & Winston.

King, L. J. *Statistical Analysis in Geography.* Prentice-Hall.

Siegal, S. *Nonparametric Statistics for the Behavioural Sciences.* McGraw-Hill.

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.

27.103 Climatology

Spatial and temporal distribution of atmospheric components of special relevance to the exchange of energy and water at the earth surface. 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. Present and past world climatic patterns in relation to energy and water balance principles. 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, and toward 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.

TEXTBOOKS

Miller, D. H. *A Survey Course. The Energy and Mass Budget at the Surface of the Earth.* Assoc. Amer. Geog.

Sellers, W. D. *Physical Climatology.* Chicago U.P.

REFERENCE BOOKS

Bradley, E. F. & Denmead, O. T. eds. *The Collection and Processing of Field Data.* Wiley.
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.
Munn, R. E. *Biometeorological Methods.* Academic, N.Y., 1970.

27.203 Biogeography

The physical environment as the controlling agent of species and community distributions. World distribution of plants and animals over time, with particular reference to the Pacific area. Origin and distribution of continental biotas. Island biogeography. Migrations and evolution associated with climatic changes. Man as an ecological dominant.

TEXTBOOK

Darlington, P. J. *Biogeography of the Southern End of the World.* Harvard U.P.
McArthur, R. L. & Wilson, E. O. *The Theory of Island Biogeography.* Monographs in Population Biology I. Princeton U.P.

REFERENCE BOOKS

Baker, H. G. & Stebbins, G. L. eds. *The Genetics of Colonising Species.* Academic.
Barnett, S. A. ed. *A Century of Darwin.* Heinemann.
Beadle, N. C. W., Evans, O. D. & Carolin, R. L. *Handbook of Vascular Plants of the Sydney District.* Private.
Elton, C. S. *The Ecology of Invasions by Animals and Plants.* Methuen.
Gressitt, J. L. ed. *Pacific Basin Biogeography.* Bishop Museum Press.
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.
Thomas, W. L. ed. *Man's Role in Changing the Face of the Earth.* Chicago U.P.

27.204 Advanced Biogeography*

A study of the factors controlling biomass accumulation and their manipulation in land use and conservation. Production ecology: the efficiency of vegetation in using the environment; microclimate, energy, carbon dioxide and water vapour fluxes and how they control the rates of production; nutrient cycling, the distribution of chemical elements in selected ecosystems, rates of cycling and the role of fire in nutrient cycling; spatial relationships, species area, area of influence, stand density, leaf area index, and root/shoot ratios. Vegetation expression of environmental gradients; vegetation response to changes in environment with particular reference to grazing, soil erosion and forest management. Vegetation cover and the hydrologic cycle. Administrative and legal aspects of conservation. Laboratory sessions supporting the lectures: experimental methods and data collection and collation in biomass, microclimatic, nutrient cycling and spatial relationship studies; visits to projects on conservation and land management.

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.

* Not to be introduced before 1973.

27.303 Transportation Geography

Includes the structure of transportation systems, for example modal systems, network and flow analysis, communication and circulation theories, and the analysis of specific problems, for example transport and economic development and highway impact studies. Laboratory classes include case studies and practical applications.

REFERENCE BOOKS

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.
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.
Smith, R. H. T., Taaffe, E. & King, L. eds. *Readings in Economic Geography*. Rand McNally.
Taaffe, E. & Gauthier, W. *Geography of Transportation*. Prentice-Hall.

27.304 Advanced Economic Geography

In Session 1 topics include the formulation of economic models in an interregional framework, linear programming and activity analysis, growth models, growth pole concepts, the spatial transmission of economic growth, and the spatial pattern of short term economic interaction, with emphasis on North America. In Session 2 students attend a series of seminars on the general development of geographic thought and ideas.

TEXTBOOK

Richardson, H. *Regional Economics*. Weidenfeld & Nicolson.

REFERENCE BOOKS

Beckmann, M. *Location Theory*. Random House.
Friedmann, J. *Regional Development Policy*. M.I.T. Press.
Friedmann, J. & Alonso, W. *Regional Development and Planning*. M.I.T. Press.
Isard, W. *Methods of Regional Analysis*. M.I.T. Press.
Nourse, H. O. *Regional Economics*. McGraw-Hill.
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 Theory

Classical and more recent adaptations of location theory. Consideration of external economies. City and regional structure. Spatial competition and patterns of location. Emphasis on an examination of the effects of the spatial distribution of resources and markets on the locational equilibrium of the firm. Decision theory relevant to location.

TEXTBOOK

Richardson, H. W. *Regional Economics*. Weidenfeld & Nicolson.

REFERENCE BOOKS

Brown, L. A. *Diffusion Processes—Location.* Reg.Sci.Res.Inst.Bib. Series 4.
Christaller, W. *Central Places in Southern Germany.* Prentice-Hall.
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.
Karaska, G. J. & Bramhall, D. F. eds. *Locational Analysis for Manufacturing: A Selection of Readings.* M.I.T. Press.
Lösch, A. *Economics of Location.* Wiley.
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.
Stevens, B. & Brackett, C. *Industrial Location*—Bibliography. Reg.Sci. Res.Inst.
Weber, A. *Theory of Location of Industries.* Chicago U.P.

27.323 Marketing Geography

Organisation and operation of the marketing system including the optimal location of consumer orientated enterprises and the analysis of market areas. Spatial behaviour of consumers in the market for various goods and services, with emphasis upon consumer search and decision processes.

TEXTBOOKS

Engel, J. F., Kollatt, D. T. & Blackwell, R. D. *Consumer Behaviour.* Holt, Rinehart & Winston.
Scott, P. *Geography and Retailing.* Hutchinson. Paperback.

REFERENCE BOOKS

Arndt, J. ed. *Insights into Consumer Behaviour.* Allyn & Bacon.
Bartels, R. *The Development of Marketing Thought.* Irwin.
Berry, B. J. L. *Geography of Market Centres and Retail Distribution.* Prentice-Hall.
Berry, B. J. L. *Commercial Structure and Commercial Blight.* University of Chicago, Dept. of Geography, Research Paper No. 85.
Brush, J. E. & Gauthier, H. L. *Service Centres and Consumer Trips.* University of Chicago, Dept. of Geography, Research Paper No. 113.
Carman, J. M. *The Application of Social Class in Market Segmentation.* Instit. of Business & Economic Research, University of California, Berkeley.
Engel, J. F. ed. *Consumer Behaviour: Selected Reading.* American Marketing Association.
Fisk, G. *Marketing Systems.* Harper.
Garner, B. J. *The Internal Structure of Retail Nucleations.* Northwestern University Studies in Geography, No. 12.
Lewis, E. H. *Marketing Channels: Structure and Strategy.* McGraw-Hill. Paperback.
Mueller, W. F. & Garoian, L. *Changes in the Market Structure of Grocery Retailing.* Wisconsin U.P.
Revzan, D. *Wholesaling in Marketing Organisation.* Wiley.
Simmons, J. *The Changing Pattern of Retail Location.* University of Chicago, Dept. of Geography, Research Paper No. 92.
Simmons, J. *Toronto's Changing Retail Complex.* University of Chicago, Dept. of Geography, Research Paper No. 104.
Vance, J. E. *The Merchant's World: The Geography of Wholesaling.* Prentice-Hall.

27.333 Agricultural Geography

Rent theory in relation to agricultural systems. Systems of agriculture at different levels of economic development, and in relation to cultural and institutional factors. Effect on agriculture of rural-urban competition for resources. Examples will be drawn from Australasia and South East Asia. Laboratory classes include case studies.

REFERENCE BOOKS

Barlowe, R. *Land Resource Economics.* Prentice-Hall.
Barnard, A. ed. *The Simple Fleece: Studies in the Australian Wool Industry.* M.U.P.
Brookfield, H. C. & Brown, P. *Struggle for Land: Agriculture and Group Territories among the Chimbu of the New Guinea Highlands.* O.U.P.
Chisholm, M. *Rural Settlement and Land Use.* Hutchinson.
Courtenay, P. P. *Plantation Agriculture.* Bell.
Davidson, B. R. *The Northern Myth.* M.U.P.
Davidson, B. R. *Australia Wet or Dry?* M.U.P.
Dunn, E. S. Jr. *The Location of Agricultural Production.* Florida U.P.
Dumont, R. *Types of Rural Economy.* Methuen.
Fisher, C. A. *South East Asia.* Methuen.
Gourou, P. *The Tropical World.* Longmans.
Gregor, H. G. *Geography of Agriculture: Themes in Research.* Prentice-Hall.
Heady, E. O. *Economics of Agricultural Production and Resource Use.* Prentice-Hall.
Hoover, E. M. *The Location of Economic Activity.* McGraw-Hill.
Laut, P. *Agricultural Geography.* Vols. 1 and 2. Nelson.
Nourse, H. O. *Regional Economics.* McGraw-Hill.
Rutherford, J. & Langford-Smith, T. *Water and Land: Two Case Studies in Irrigation.* A.N.U. Press.
Rutherford, J., Logan, M. I. & Missen, G. J. *New Viewpoints in Economic Geography.* Martindale.
Slatyer, R. O. & Perry, R. A. *Arid Lands of Australia.* A.N.U. Press.
Symons, L. *Agricultural Geography.* Bell.
Wadham, S., Wilson, R. K. & Wood, J. *Land Utilisation in Australia.* M.U.P.

27.403 Geomorphology and Pedology

Part I. *Geomorphology.* Fluvial processes and valley features. Hillslopes and slope mantles. Further study of morphogenetic systems selected from arid, glacial and periglacial, savanna and humid tropical zones. Coastal, volcanic, structural and neotectonic landforms. Case studies illustrating approaches to geomorphic investigations. Classification and mapping of landforms, including airphoto interpretation. Morphometry. Laboratory study of aeolian, fluvial, beach and colluvial materials.

TEXTBOOKS

Bird, E. F. C. *Coastal Landforms.* A.N.U. Press.
Chorley, R. J. ed. *Water, Earth and Man.* Methuen.
Davies, J. L. *Landforms in Cold Climates.* A.N.U. Press.
Morisawa, M. *Streams: their Dynamics and Morphology.* McGraw-Hill.

REFERENCE BOOKS

Allen, J. R. L. *Physical Processes of Sedimentation.* Unwin.
Chow, Ven Te. *Handbook of Applied Hydrology.* McGraw-Hill.
Dury, G. H. *Rivers and River Terraces.* Macmillan.
Embleton, C. & King, C. A. M. *Glacial and Periglacial Geomorphology.* Arnold.
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 in Geomorphology.* Freeman.
Miller, V. C. *Photogeology.* McGraw-Hill.
Selby, M. J. *Slopes and Slope Processes.* N.Z. Geog. Soc. (Waikato Branch).
Thornbury, W. D. *Principles of Geomorphology.* Wiley.
Tricart, J. *Geomorphology of Cold Environments.* Macmillan.

Part II. *Pedology:* Morphologic, physical and chemical properties of soil, including colour, texture, consistence, structure, aeration, moisture, reaction and nutrients. Physical and chemical aspects of soil fertility; soil erosion and conservation. The zonal concept; soil-landscape relationships. Palaeopedology, including polygenesis and soil stratigraphy. The soil-forming processes of the major Great Soil Groups and their management problems. Laboratory classes include particle size grading, specific gravity and moisture content of soils, soil reaction determination, conductivity and estimation of major plant nutrients; soil profile description; soil survey and mapping; analysis of soil maps.

TEXTBOOK
Corbett, J. R. *The Living Soil.* Martindale.

REFERENCE BOOKS
Baver, L. D. *Soil Physics.* Wiley.
Bear, F. E. ed. *The Chemistry of the Soil.* Arnold.
Black, C. A. ed. *Methods of Soil Analysis.* Amer. Soc. Agron. Inc.
Dasmann, R. F. *Environmental Conservation.* Wiley.
Kohnke, H. *Soil Physics.* McGraw-Hill.
Jenny, H. *The Factors of Soil Formation.* McGraw-Hill.
Leeper, G. W. *Introduction to Soil Science.* M.U.P.
Robinson, G. W. *Soils, their Origin, Constitution and Classification.* Murby.
Rose, C. W. *Agricultural Physics.* Pergamon.
Russell, E. W. *Soil Conditions and Plant Growth.* Longmans Green.
Stace, G. 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, its causes and control by mechanical and biological measures in a range of environments including coastal dunes, hillslopes scalds and inland dunes. The history of geomorphology and pedology, the passage of concepts, and current problems. Laboratory classes include the study of correlative sediments, soils, and depositional environments. A field tutorial of about one week before the beginning of first session traversing geomorphic and pedologic environments in South-eastern Australia.

TEXTBOOKS
Brewer, R. *Mineral and Fabric Analysis of Soils.* Wiley.
Folk, R. L. *Petrology of Sedimentary Rocks.* Hemphills.

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.
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. Press.
Embleton, C. & King, C. A. M. *Glacial and Periglacial Geomorphology.* Arnold.
Fairbridge, R. *Encyclopedia of Geomorphology.* Reinhold.
Jennings, J. N. & Mabbutt, J. A. eds. *Landform Studies from Australia and New Guinea.* A.N.U. Press.
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.
Ollier, C. D. *Weathering.* Oliver & Boyd.
Selby, M. J. *Slopes and Slope Processes.* N.Z. Geog. Soc. (Waikato Branch).
Stace, G. T. et. al. *A Handbook of Australian Soils.* Rellim.

27.504 Projects in Applied Geography

Biogeography: study of the vegetation in an area, and detailed consideration of a problem arising from this survey, preferably with an applied aspect. *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.

27.901G Geomorphology for Hydrologists

General concepts of landscape evolution; geomorphic aspects of overland and channel flow; lithologic and structural controls of surface drainage; stream channels in cross-section, plan and long profile; floodplain characteristics; hillslopes; geomorphic relationships of surficial deposits; catchment morphometry; landscape features due to underground water; landforms and processes of the main morphogenetic zones; drainage types in Australia; vigil and representative catchments; the land-system approach to water resource assessment; air photo and map analysis of characteristic landforms and drainage features; geomorphic and land system mapping; field study of a vigil catchment.

TEXTBOOKS

Leopold, L. B. Wolman, M.G., and Miller, J. P. *Fluvial Processes in Geomorphology.* Freeman.
Morisawa, M. *Streams: their Dynamics and Morphology.* McGraw-Hill. Paperback.
Thornbury, W. D. *Principles of Geomorphology.* International edition. Wiley.

REFERENCE BOOKS

Chorley, R. J. ed. *Water, Earth and Man.* Methuen.
Chorley, R. J. & Haggett, P. eds. *Models in Geography.* Methuen.
Chow, Ven Te. *Handbook of Applied Hydrology.* McGraw-Hill.
Dury, G. H. ed. *Essays in Geomorphology.* Heinemann.
Dury, G. H. ed. *Rivers and River Terraces.* Macmillan.
Haggett, P. & Chorley, R. J. *Network Analysis in Geography.* Methuen.
Jennings, J. N. & Mabbutt, J. A. eds. *Landform Studies from Australia and New Guinea.* A.N.U. Press.
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.

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.

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.

27.903G Geographic Background to Pollution Problems

Interactions between topographic, climatic and hydrologic factors in relation to urbanization and pollution. Soil formation, erosion and fertility. Industrial and transport pollution problems. City-size and pollution; urban renewal. Economic and social implications of pollution.

REFERENCE BOOKS

Chow, Ven Te. *Handbook of Applied Hydrology.* McGraw-Hill.
Corbett, J. R. *The Living Soil.* Martindale.
Griffin, R. J. *The Botany Basin.* Geol. Surv. of N.S.W. Bull. No. 18.
Hunter, A. ed. *The Economics of Australian Industry.* M.U.P.
Proceedings of Clean Air Conference. 1962 and 1965. N.S.W.U.P.
Rutherford, J., Logan, M. I. and Missen, G. J. *New Viewpoints in Economic Geography.* Martindale.
Smith, D. *Industrial Location.* Wiley.
Taylor, G. *Sydneyside Scenery.* A. & R., 1970.
Walker, P. H. *A Soil Survey of the County of Cumberland.* Bull. No. 2. Soil Survey Unit, N.S.W. Dept. of Agriculture.

DEPARTMENT OF MARKETING

28.104 Marketing Models and Systems

TEXTBOOKS

Enis, B. M. G. & Cox, K. A. *Marketing Classics.* Allyn & Bacon, 1969.
Fisk, G. *Marketing Systems.* Harper & Rowe, 1967.
King, W. R. *Quantitative Analysis for Marketing Management.* McGraw-Hill, 1967.
Scott, R. A. & Marks, N. E. *Marketing and its Environment: Some Issues and Perspectives.* Wadsworth, 1968.

SCHOOL OF SURVEYING

29.441 Engineering Surveying

TEXTBOOKS

Bannister, A., and Raymond, S. *Surveying*. Pitman, 1967. Paperback.
Seven Figure Mathematical Tables. Chambers, 1958 (full edition).

SCHOOL OF ARCHITECTURE AND BUILDING

36.471 Planning Law and Administration

TEXTBOOK

N.S.W.—Parliament—Statutes. *Local Government Act 1919*. Govt. Printer. Sydney, 1966.

SCHOOL OF BIOCHEMISTRY

41.101A Chemistry of Biologically Important Molecules

TEXTBOOKS

The Molecular Basis of Life. An Introduction to Molecular Biology. Readings from *Scientific American*. Freeman, 1968.
Loewy, A. G. & Seikevitz, P. *Cell Structure and Function*. 2nd ed. Holt, Rinehart & Winston, 1969.
Segal, I. H. *Biochemical Calculations*. Wiley, 1968.
White, A., Handler, R. & Smith, E. L. *Principles of Biochemistry*. 4th ed. McGraw-Hill, 1968.

41.101B Metabolism

TEXTBOOKS

As for 41.101A.

41.101C Control Mechanisms

TEXTBOOKS

As for 41.101A.

41.102A Biochemistry of Macromolecules and Cell Biochemistry

TEXTBOOKS

Davidson, J. N. *The Biochemistry of the Nucleic Acids*. 6th ed. Methuen, 1969.
The Molecular Basis of Life. An Introduction to Molecular Biology. Readings from *Scientific American*. Freeman, 1968.
Segal, I. H. *Biochemical Calculations*. Wiley, 1968.
White, A., Handler, R. & Smith, E. L. *Principles of Biochemistry*. 4th ed. McGraw-Hill, 1968.

41.102B Metabolic Pathways and Control Mechanisms

TEXTBOOKS

As for 41.102A above.

SCHOOL OF BIOLOGICAL TECHNOLOGY

42.102 Fermentation Technology

TEXTBOOKS

Casida, L. E., Jr. *Industrial Microbiology*. Wiley, 1968.
Rhodes, A. & Fletcher, D. *Principles of Industrial Microbiology*. Pergamon, 1966.

42.201G Principles of Biology

TEXTBOOK

Loewy, A. G., and Siekevitz, P. *Cell Structure and Function*. 2nd ed. Holt, Rinehart & Winston, 1969.

42.202G Principles of Biochemistry

TEXTBOOKS

Ambrose, E. J. & Easty, D. M. *Cell Biology*. Nelson, 1970.
Mahler, H. R. & Cordes, E. H. *Biological Chemistry*. Harper int. ed. 1968.

42.203G Biochemical Methods

No specified textbook.

42.204G Microbial Processes

TEXTBOOK

Rhodes, A. & Fletcher, D. *Principles of Industrial Microbiology*. Pergamon, 1966.

SCHOOL OF BOTANY

43.101A/45.101A Genetics & Biometry

TEXTBOOKS

Clarke, M. C. *Statistics and Experimental Design*. Arnold, 1969.
Rohlf, F. T. & Sokal, R. *Statistical Tables*. Freeman, 1969.
Srb, A. M., Owen, R. D. & Edgar, R. S. *General Genetics*. 2nd. ed. Freeman, 1965.

43.101B Plant Evolution and Ecology

TEXTBOOKS

Beadle, N. C. W., Carolin, R. C., and Evans, O. D. *Handbook of the Vascular Plants of the Sydney District and Blue Mountains*. 1962.
Billings, W. D. *Plants and the Ecosystem*. Macmillan, 1964.
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