FACULTY OF APPLIED SCIENCE

1971 HANDBOOK

THE UNIVERSITY OF NEW SOUTH WALES

80 CENTS

FACULTY OF APPLIED SCIENCE

1971 HANDBOOK

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THE UNIVERSITY OF NEW SOUTH WALES

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TABLE OF CONTENTS

UNDERGRADUATE STUDY

POSTGRADUATE STUDY

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 Geology, Chemical Engineering, Chemical Technology, Metallurgy, Mining Engineering, Textile Technology and Wool and Pastoral Sciences are well established, and a new course in Applied Geography was offered for the first time in 1967. 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 1971

Session 1: March 1 to May 15

May Recess: May 16 to May 23

May 24 to June 12

Midyear Recess: June 13 to July 18

Session 2: July 19 to August 14

August Recess: August 15 to August 29

August 30 to November 6

JANUARY

Monday 25	Last day for acceptance of applications to enrol by new students and students repeating first year
Tuesday 26 to Saturday, Feb. 6	Deferred examinations

FEBRUARY

Monday 1	Australia Day—Public Holiday
Thursday 18 to Monday 22	Enrolment period for new students and students repeating first year
Monday 22	Enrolment week commences for students re-enrolling (second and later years)

MARCH

Monday 1	**Session 1 lectures commence**
Friday 12	Last day of enrolment for new students (late fee payable)
Wednesday 31	Last day for later year enrolments (late fee payable)

APRIL

Friday 9 to Monday 12	Easter
Monday 26	Anzac Day—Public Holiday

MAY

Sunday 16 to Sunday 23	May Recess

JUNE

Saturday 12	**Session 1 ends**
Monday 14	Queen's Birthday—Public Holiday
Tuesday 15	Midyear examinations begin
Tuesday 29	Midyear examinations end
Wednesday 30	Last day for acceptance of applications for re-admission after exclusion under rules governing re-enrolment

JULY

Monday 19	**Session 2 commences**
Thursday 29	Foundation Day

AUGUST

Sunday 15 to Sunday 29	August Recess

SEPTEMBER

Wednesday 15	Last day for acceptance of corrected enrolment details forms

OCTOBER

Monday 4	Eight Hour Day—Public Holiday
Wednesday 6	Last day for acceptance of corrected enrolment details forms (late fee payable)

NOVEMBER

Saturday 6	**Session 2 ends**
Tuesday 9	Annual examinations begin

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

Tuesday 25 to Saturday, Feb. 5	Deferred examinations

FEBRUARY

Monday 14	Enrolment Week commences for new students and students repeating first year
Monday 21	Enrolment Week commences for students re-enrolling

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
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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 1971 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) Sheep and Wool Technology (Education option) course	(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	Nil As for Arts As for Commerce
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	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 I	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

Section B

Supplementary Provisions for Matriculation

1. Notwithstanding the provisions of Section A above, candidates may be accepted as "matriculated students" of the University under the following conditions subject to the approval of the Professorial Board:—

(a) Any person who holds a diploma from the New South Wales, Department of Technical Education, or any other Technical College which may, from time to time, be recognized by the University, may be admitted to the University as a "matriculated student" with such status as the Board may determine, provided that, in the opinion of the Board, the applicant's qualifications are sufficient for matriculation to the Faculty nominated.

(b) The Board may admit as a "matriculated student" in any Faculty with such status as the Board may determine in the circumstances—

(i) a graduate of any approved University,

(ii) an applicant who presents a certificate from a University showing that he has a satisfactory record and is qualified for entrance to that University, provided that in the opinion of the Board there is an acceptable correspondence between the qualifying conditions relied upon by the applicant and conditions laid down for matriculation to the nominated Faculty of the University of New South Wales.

(c) (i) any person who has completed the first year of the course at the Royal Military College of Australia and submits a certificate from the Commandant to that effect may be admitted as a "matriculated student" of the University,

(ii) any person who has completed a full course of at least three years' prescribed study at the Royal Military College of Australia and produces a certificate from the Commandant to that effect may be admitted as a "matriculated student" of the University with such status as the Board may determine.

(d) Any person who has completed satisfactorily the passing out examination of the Royal Australian Naval College and submits a certificate from the Commanding Officer may be admitted as a "matriculated student" of the University.

(e) (i) any person who has completed the first year of the course at the Royal Australian Air Force College and submits a certificate from the Commandant to that effect, may be admitted as a "matriculated student" of the University,

(ii) any person who has completed two years of the course at the Royal Australian Air Force College and submits a certificate from the Commandant to that effect, may be admitted as a "matriculated student" of the University with such status as the Board may determine.

(f) An applicant who presents a certificate from another University showing that he is qualified for entrance to that University and setting out the grounds of such qualification, provided that in the opinion of the Professorial Board, there is an acceptable correspondence between the qualifying conditions relied upon by the applicant and the conditions laid down for matriculation to the nominated Faculty of the University of New South Wales.

2. (a) The Professorial Board may in special cases, including cases concerning persons of other than Australian education, declare any person qualified to enter a Faculty as a "provisionally matriculated student" although he has not complied with the requirements set out above, and in so doing may prescribe the completion of certain requirements before confirming the person's standing as a "matriculated student". Students who satisfactorily complete these requirements will be permitted to count the courses so passed as qualifying for degree purposes.*

(b) Persons over the age of twenty-five years may be admitted to provisional matriculation status provided that —

(i) they have satisfactorily completed an approved course of systematic study extending over at least three years after passing the School Certificate Examination, or

* The Professorial Board has determined that normally confirmation of standing as a "matriculated student" will require the successful completion of not less than half the normal programme in the first year of enrolment.

(ii) they satisfy the Professorial Board that they have reached a standard of education sufficient to enable them profitably to pursue the first year of the proposed course.

(c) Any applicant for provisional status may be required to take such examination as the Professorial Board may prescribe before such status is granted.

3. The Professorial Board may, at its discretion, permit a person, who does not satisfy the requirements for admission, to attend lectures in a subject or subjects at the University, on payment of the prescribed fees provided that such person shall not necessarily have the privileges of "matriculated students" and shall not be eligible to proceed to a degree.

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 1971 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 30th October, 1970.

(b) New South Wales residents qualifying for admission by the 1970 New South Wales Higher School Certificate Examination or the 1971 Sydney University Matriculation Examination and those who have attended a University in New South Wales in 1970 must apply for enrolment to the Metropolitan Universities Admissions Centre, 13-15 Wentworth Avenue, Sydney (P.O. Box 7049 G.P.O., Sydney) by 25th January, 1971.

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. 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 all subjects at the 1970 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.

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.

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.

Course details must be completed during the prescribed Enrolment Week. For details of fee requirements, including late fee provisions, see under Fees.

Final Dates for Completion of Enrolment. No enrolments will be accepted from *new students* after the end of the second week of Session 1 (12th March, 1971) 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 in the space at the top right-hand corner 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 by mail to their term address as soon as possible after fee payment. In the meantime, the fees receipt form should be carried during attendance at the University and shown on request. If the Union card is not received within three weeks of fee payment the University Union should be notified.

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)—$198 per session.

(ii) Part-time Course Fee—over 6 hours' and up to 15 hours' attendance per week—$99 per session.

(iii) Part-time Course Fee—6 hours' or less attendance per week—$49.50 per session.

(iv) Course Continuation Fee—A fee of $28 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—$8—payable at the beginning of first year.

Library Fee—annual fee—$14.

University Union—$20—entrance fee.

Student Activities Fees

University Union*—$20—annual subscription.
Sports Association*—$4—annual subscription.
Students' Union*—$5—annual subscription.
Miscellaneous—$17—annual fee.

Graduation or Diploma Fee—$8 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 (botany, zoology, entomology).

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

Special Examination Fees

Deferred examination—$6 for each subject.

Examinations conducted under special circumstances—$8 for each subject.

Review of examination result—$8 for each subject.

LATE FEES

First Enrolments

Fees paid at the late enrolment session and before the commencement of Session 1	$7
Fees paid during the first and second weeks of Session 1	$14
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	$28

Re-Enrolments

Session 1

Failure to attend enrolment centre during enrolment week	$7
Fees paid after the commencement of the third week of Session 1 to 31st March	$14
Fees paid after 31st March where accepted with the express approval of the Registrar	$28

Session 2

Fees paid in third and fourth weeks of Session 2	$14
Fees paid thereafter	$28
Late lodgement of corrected enrolment details forms (late applications will be accepted for three weeks only after the prescribed dates)	$6

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 $7.

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., 12th March, 1971), 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 Term

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 (13th August, 1971).

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.

COURSE TRANSFERS

Students wishing to transfer from one course to another must apply on an application form obtainable from the Admissions Office, Chancellery, by Monday, 25th January. As quotas will operate on entry to all Faculties and the Board of Vocational

Studies in 1971, failure to apply by 25th January 1971 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 or add one or more subjects to their programme must make application to the Head of the School responsible for the course on a form available from School offices. In the case of students wishing to withdraw from subjects or 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 academic penalty 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 25th January, 1971. 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 $6 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 $6 per subject, by the date indicated on the notification of results.

APPLICATION FOR ADMISSION TO DEGREE OR DIPLOMA

Applications for admission to a degree or diploma of the University must be made on the appropriate form by 15th January. Applicants should ensure that they have completed all requirements for the degree or diploma, 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 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 by decision of the Professorial Board under the provisions of these rules may appeal to an Appeal Committee constituted by Council for this purpose.

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. 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 Committee of Review.

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 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 senior undergraduates (full-time students who have completed three years of their course and part-time students who have completed four years of their course and up to 400 of those who have completed three years of a part-time course), and post-graduate students may apply for parking permits. 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 $280 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 $21.00 per week. 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 $21.00 per week. 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 Student Amenities Unit where 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 between 18 and 30 years of age who are not in employment or in receipt of any income or remuneration.

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 overseas, inter-state and intra-state are available under the conditions ruling for the various operating companies.

(i) Airlines of N.S.W. T.A.A. Ansett — Full-time students, not in receipt of remuneration and under 26 years of age, pay three-quarters of the normal adult fare. An identification card, which is obtainable at the Students' Union Office, is required to obtain this concession. Identity cards of any of the three airlines are honoured by the other two.

(ii) East West Airlines Full-time students, not in receipt of remuneration, pay two-thirds of the normal adult fare.

Location:

The Student Amenities Unit at Kensington is located on College Road, opposite the gateway to Baxter and Goldstein Colleges. (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 a qualified medical practitioner, 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.

STUDENT COUNSELLING AND RESEARCH UNIT

Prospective students seeking advice or guidance regarding the selection and planning of courses (particularly in relation to a career), or advice regarding their suitability for a particular course, are invited to consult the University's Student Counselling and Research Unit. Appointments may be made by telephone (663-0351, extensions 2600 to 2605).

In addition to its counselling service, the Unit provides a variety of study skills programmes throughout the year, on a group or individual basis. Programmes offered in the past have included Reading Improvement, Study Methods, Written Expression, Note Taking, Studying Mathematics, Improving Listening, Preparing for Statistics.

Films, tape recordings and special reading equipment have been used as aids by the counsellors managing the group counselling activities.

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 $200 from the Student Loan Fund established from contributions made by the Students' Union and the University. Thirdly, a Students' Union donation of $1,000 has made possible urgent cash loans not exceeding $50 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 results of the Higher School Certificate Examination.

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 at least one year of a full-time or two years of a part-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 $620 per annum or $1,000 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 results of the New South Wales Higher School Certificate examination.

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, c/- Department of Education, Bridge Street, Sydney.

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.

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.

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.

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 satis-

fied 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 scholarship in Ceramic Engineering to the value of $900 per annum. The scholarship will normally be tenable for four years.

Applicants must be British subjects and are expected to apply for a Commonwealth Scholarship to cover course and other University fees.

The 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.

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 1970), and has a value of between $200 to $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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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 notification of Higher School Certificate results.

Scholarships in Mining Engineering Offered by Various Companies

A number of companies associated with the development of the mining industry in Australia have combined to provide scholarships for students wishing to qualify for the degree of Bachelor of Engineering in Mining Engineering (Pass or Honours). The companies are: Amad N.L., Consolidated Tin Smelters Ltd., Derby & Co. (Aust.) Pty. Ltd., Freeport Sulphur Co. of Australia Inc., Kenneth McMahon & Partners Pty. Ltd., Mineral Securities Aust. Ltd., Petroleum Securities Aust. Ltd. These scholarships have a value of $1,000 per annum, payable in fortnightly instalments over the academic year, and will normally be tenable for one or two years. They may be held concurrently with a Commonwealth Scholarship.

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.

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.

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, 1971.

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).

Full-Time Courses

Full-time courses of four years' duration leading to the degree of Bachelor of Science are offered in Food Technology, Industrial Chemistry, Ceramic Engineering, Applied Geography, Metallurgy, Applied Geology, 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 Christmas 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 and Broken Hill). A part-time course in Mineral Processing is also available at Broken Hill.

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 B.Sc.(Tech.) degree will be eligible to proceed to the degrees 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 B.Sc.(Tech.) courses, but one of the conditions for the award of the B.Sc.(Tech.) degree 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.

B.Sc. (Tech.) Courses With Partial Full-Time Attendance

B.Sc.(Tech.) 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.

Allocation of Study Hours

In the outlines of the courses in the Faculty of Applied Science set out below the following scheme for indicating the allocation of study hours is used. The first two figures for each subject indicate the number of hours spent each week in lectures and tutorials/laboratory work respectively. The third figure is intended to be a guide to the average student as to the time he should devote to private study of the particular subject if he expects to reach pass standard in that subject. The academic load for most full-time courses is in the range of 45 to 50 hours per week.

SCHOOL OF APPLIED GEOLOGY

The development of natural resources and the allied engineering activities make essential 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 and basic engineering subjects as well as introductory geology. Later geological instruction is developed and emphasis is placed progressively on engineering application 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) in Geology is 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.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
1.031	Physics IAS	3	3	3½	3	3	3½
2.001	Chemistry I	2	4	5	2	4	5
10.001	Mathematics I *or*						
10.011	Higher Mathematics I	4	2	4	4	2	4
25.001	Geology I*	3	3	4½	3	3	4½
		12	12	17	12	12	17

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

YEAR 2							
1.212	Physics IIT (units B and C)	1½	1½	2	1½	1½	2
2.022	Chemistry II (M)	3	2½	5	3	2½	5
10.031	Mathematics	1	1	2	1	1	2
10.331	Statistics	1	1	1½	1	1	1½
25.002	Geology II*	5	4	6	4	5	6
	General Studies Elective	1	½	2	1	½	2
		12½	10½	18½	11½	11½	18½

* Fieldwork, up to two weeks in all, is an essential part of the course. It includes a field training period of approximately one week.

YEAR 3							
25.003/1 25.003/2	Geology III, Part 1* Geology III, Part 2	7	6	13	7	5	12
25.013	Geology IIIS†	7	4	12	5	6	10
	Two General Studies Electives	2	1	4	2	1	4
		16	11	29	14	12	26

* 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.

† Includes a ten-day field tutorial.

YEAR 4		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2† Lec.	Lab. Tut.	Pvte. Study
7.551	Mining and Mineral Process Engineering	2	2	3	0	0	0
8.241	Geomechanics	2	3	3	0	0	0
25.004/1	Geology IV, Part 1*	2	1	3	0	0	0
25.004/2	Geology IV, Part 2*	2	2	4	0	0	0
25.004/3	Geology IV, Part 3*	3	1	5	0	0	0
25.004/4	Geology IV, Part 4*	1½	2	2	0	0	0
25.004/5	Geology IV, Part 5*	0	0	0	0	30	0
	General Studies Advanced Elective	1	½	3	1	½	3
		13½	11½	23	1	30½	3

† 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.

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.

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 that they 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.

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.

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

The full-time course in Chemical Engineering has been revised, to include a choice of electives in Years 2, 3 and 4, allowing students to orient their studies towards appropriate industries. The new second year course was implemented in 1970, and the third and fourth years will be provided in 1971 and 1972 respectively. Students completing Year 3 in 1970 will continue with the old course in the 1969 Calendar. All other students will take the new course. 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). 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.

Successful completion of the B.E. course is accepted by the Council of Engineering Institutions, U.K., and the Institution of Engineers, Australia, as sufficient qualification for corporate membership.

		Hours per week					
		SESSION 1			SESSION 2		
YEAR 1		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
1.031	Physics IAS	3	3	3½	3	3	3½
2.001	Chemistry I	2	4	5	2	4	5
5.001	Engineering I	3	3	4½	3	3	4½
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	4	2	4
		12	12	17	12	12	17
YEAR 2							
2.002	Chemistry IIS	5	3	7	3	7	9
3.111	Chemical Engineering Principles I	2	0	2	1	2	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	2	1	2	2
8.112	Materials and Structures	1	2	1½	1	2	1½
10.031	Mathematics	1	1	2	1	1	2
10.331	Statistics	1	1	1½	1	1	1½
	Two General Studies Electives	2	1	2	2	1	2
		13	10	18	10	16	20

		Hours per week					
		SESSION 1			SESSION 2		
		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
YEAR 2 (Cont.)							
	Plus *one* of the following Electives:						
1.212	Physics IIT— B. Electronics *or*	0	0	0	1½	1½	2
	C. An Introduction to Solids	1½	1½	2	0	0	0
3.311	Fuel Engineering I	1½	½	2	1½	½	2
4.031	Physics of Metals	1	2	2	1	0	2
25.201	Mineralogy	1	1	2	1	1	2
44.111	Microbiology	1	2	2	1	2	2
YEAR 3							
3.121	Chemical Engineering Principles II	4	7	7	0	3	3
3.122	Chemical Engineering Thermodynamics and Reaction Engineering	2	1	2	2	1	2
3.123	Chemical Engineering Design I A and B	1½	1½	3	5½	5½	9
6.801	Electrical Engineering	1	2	2	1	2	2
10.032	Mathematics	1	1	2	1	1	2
	General Studies Elective	1	½	1	1	½	1
		10½	13	17	10½	13	19
	Plus *one* of the following electives:						
2.221	Chemistry and Enzymology of Foods	3		3	3		3
3.321	Fuel Engineering II	3		3	3		3
4.121	Principles of Metal Extraction	3		3	3		3
7.551S	Mining and Mineral Processing, Part 2	2		2	2		2
18.121	Production Management	3		3	3		3
22.111	Industrial Chemistry I (Chemical Process Equipment)*	3		3	3		3
	Any Year 2 elective not previously studied						

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

YEAR 4		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
3.131	Chemical Engineering Principles III	1	1	2	1	1	2
3.132	Chemical Engineering Process Dynamics and Control	1	4	4	1	4	4
3.133	Chemical Engineering Design II	2	6	8	0	0	0
	General Studies Elective	1	½	1	1	½	1
	Project*	0	2	2	0	10	10
		5	13½	17	3	15½	17
	Plus *one or more* of the following electives to a total of 7 hrs/week for 28 weeks.						
3.134	Chemical Engineering Principles IVA	4	0	4	4	0	4
3.135	Chemical Engineering Principles IVB	3	0	3	3	0	3
3.136	Oil and Gas Engineering	3	0	3	3	0	3
3.233	Food Technology	7	0	7	7	0	7
3.331	Fuel Engineering IIIA	3	0	3	3	0	3
3.332	Fuel Engineering IIIB	4	0	4	4	0	4
3.411	Biological Process Engineering	7	0	7	7	0	7
7.311	Mineral Processing I	6	0	6	6	0	6
18.551	Operations Research	3	0	3	3	0	3
23.051	Nuclear Power Technology	3	0	3	3	0	3
	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

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

This course is designed to meet the requirements of students who are employed in the chemical processing industries.

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

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. Like the full-time course, it has been revised, to include the selection of electives in Stages IV and V. Students completing Stage V in 1970 will take the old Stage VI, as given in the 1969 Calendar. All other students will take the new course.

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 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.

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

		Hours per week					
		SESSION 1			SESSION 2		
STAGES 1 and 2*		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
1.031	Physics IAS	3	3	3½	3	3	3½
2.001	Chemistry I	2	4	5	2	4	5
5.001	Engineering I	3	3	4½	3	3	4½
10.001 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	4	2	4
		12	12	17	12	12	17

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

		Hours per week					
		SESSION 1			SESSION 2		
STAGE 3		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
2.002	Chemistry II (S)	5	3	7	3	7	9
10.031	Mathematics	1	1	2	1	1	2
	Two General Studies Electives	2	1	2	2	1	2
		8	5	11	6	9	13
STAGE 4							
3.111	Chemical Engineering Principles I	2	0	2	1	2	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	2	1	2	2
8.112	Materials and Structures	1	2	1½	1	2	1½
10.331	Statistics	1	1	1½	1	1	1½
		5	5	7	4	7	7
	Plus *one* of the following Electives:						
1.212	Physics II— B. Electronics *or*	0	0	0	1½	1½	2
	C. An Introduction to Solids	1½	1½	2	0	0	0
3.311	Fuel Engineering I	1½	½	2	1½	½	2
4.031	Physics of Metals	1	2	2	½	0	2
25.201	Mineralogy	1	1	2	1	1	2
44.111	Microbiology	1	2	2	1	2	2
STAGE 5							
3.122	Chemical Engineering Thermodynamics and Reaction Engineering	2	1	2	2	1	2
3.123/1	Chemical Engineering Design IA	1½	1½	3	1½	1½	3
6.801	Electrical Engineering	1	2	2	1	2	2
10.032	Mathematics	1	1	2	1	1	2
		5½	5½	9	5½	5½	9

(Stage 5 continued overleaf)

		Hours per week					
		SESSION 1			SESSION 2		
STAGE 5 (Cont.)		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
	Plus *one* of the following Electives:						
2.221	Chemistry and Enzymology of foods	3		3	3		3
3.321	Fuel Engineering II	3		3	3		3
4.121	Principles of Metal Extraction	3		3	3		3
7.551S	Mining and Mineral Processing Part 2	2		2	2		2
18.121	Production Management	3		3	3		3
22.111	Industrial Chemistry I (Chemical Process Equipment)*	3		3	3		3
	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	7	0	3	3
3.123/2	Chemical Engineering Design IB	0	0	0	4	4	6
	General Studies Elective	1	½	1	1	½	1
		5	7½	8	5	7½	10

* Students will sit for examination 3.124 Combined Chemical Engineering Design and Practice at end of this stage.

Chemical Engineering B.Sc. (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
22.111 Industrial Chemistry I
22.211 Ceramics I
22.311 Polymer Science I
44.101/2 Microbiology I, Part 2
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 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. Opportunities for postgraduate studies and research for higher degrees in this area 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. 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 for students who take the full number of Fuel electives, i.e. Fuel Engineering I, II, III, and IV and the fuel project.

The course emphasizes the importance of scientific principles and their application in practice and extends over four years' full-time studies. The training in the first three years consists of instruction and laboratory work in the basic sciences and engineering.

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.

The student is advised to spend at least eight weeks in industry gaining practical experience in some field of fuel engineering. He also attends seminars and discussion groups, visits works and undertakes an individual research or design project in his final year.

		Hours per week					
		SESSION 1			SESSION 2		
YEAR 1		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
1.031	Physics IAS	3	3	3½	3	3	3½
2.001	Chemistry	2	4	5	2	4	5
5.001	Engineering I	3	3	4½	3	3	4½
10.001 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	4	2	4
		12	12	17	12	12	17

		Hours per week					
		SESSION 1			SESSION 2		
YEAR 2		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
2.002	Chemistry II (S)	5	3	7	3	7	9
3.111	Chemical Engineering Principles I	2	0	2	1	2	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	2	1	2	2
3.311	Fuel Engineering I	1½	½	2	1½	½	2
8.112	Materials and Structures	1	2	1½	1	2	1½
10.031	Mathematics	1	1	2	1	1	2
10.331	Statistics	1	1	1½	1	1	1½
	Two General Studies Electives	2	1	2	2	1	2
		14½	10½	20	11½	16½	22
YEAR 3							
3.121	Chemical Engineering Principles II	4	7	7	0	3	3
3.122	Chemical Engineering Thermodynamics and Reaction Engineering	2	1	2	2	1	2
3.123	Chemical Engineering Design 1A and B	1½	1½	3	5½	5½	9
3.321	Fuel Engineering II	1½	2½	2	1½	½	2
6.801	Electrical Engineering	1	2	2	1	2	2
10.032	Mathematics	1	1	2	1	1	2
	General Studies Elective	1	½	1	1	½	1
		12	15½	19	12	13½	21
YEAR 4*							
3.331	Fuel Engineering IIIA	4	6½	6	2	1	5
3.332	Fuel Engineering IIIB	5	6½	8	1	2½	3
3.340	Project	0	3	2	0	15	6
	General Studies Advanced Elective	2	0	4	2	0	4
		11	16	20	5	18½	18

* In process of revision for implementation in 1972.

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.

		Hours per week					
		SESSION 1			SESSION 2		
YEAR 1		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
1.031	Physics IAS	3	3	3½	3	3	3½
2.001	Chemistry I	2	4	5	2	4	5
10.001 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	4	2	4
17.001	General and Human Biology	2	4	4	2	4	4
		11	13	16½	11	13	16½
YEAR 2							
2.002	Chemistry II	5	3	7	3	7	9
3.111	Chemical Engineering Principles I	2	0	2	1	2	2
10.031	Mathematics	1	1	2	1	1	2
41.101	Units A, B, C Biochemistry I	4	8	6	2	0	4
44.101	Introductory Microbiology	1	2	2	1	2	2
	General Studies Elective	1	½	1	1	½	1
		14	14½	20	9	12½	20
YEAR 3							
2.261	Chemistry and Enzymology of Foods	2	4	3½	2	4	3½
3.211	Food Technology I, Part 1*	2	4	3½	1	2	2
3.212	Food Technology I, Part 2	0	0	0	4	8	7
3.231	Chemical Engineering	2	0	4	2	0	4
10.331	Statistics	1	1	1½	1	1	1½
44.102A	Nature of Microorganisms	2	4	4	0	0	0
	Two General Studies Electives	2	1	2	2	1	2
		11	14	18½	12	16	20

* Includes 43.111 Botany.

YEAR 4							
3.221	Food Technology II*	3	4	6	3	4	6
3.222	Project	0	8	4	0	8	4
	General Studies Elective	1	½	1	1	½	1
		4	12½	11	4	12½	11

(Year 4 continued overleaf)

* Includes 45.211 Entomology.

YEAR 4 (Cont.)		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
	Plus *one or more* of the following electives to a total of 6 hrs/week						
3.232	Chemical Engineering ..	3	0	3	3	0	3
18.121	Production Management	3	0	3	3	0	3
41.102A	Biological Macromolecules and Cell Biochemistry†	3	9	6	0	0	0
41.102B	Metabolic Pathways and Control Mechanisms†	0	0	0	3	9	6
42.102	Fermentation Technology	0	0	0	2	4	4
44.102B	Microbial Physiology and Ecology	2	4	4	0	0	0
44.102D	General Applied Microbiology	0	0	0	2	4	4

† Students electing to take biochemistry will be expected to adjust appropriately the time devoted to the Project.

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 has been designed for students already gaining practical experience in a related occupation in the food industry. The course, which covers the same subject matter as the first three years of the full-time course, extends over six years. 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.

		Hours per week					
		SESSION 1			SESSION 2		
STAGES 1 and 2*		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
1.031	Physics IAS	3	3	3½	3	3	3½
2.001	Chemistry I	2	4	5	2	4	5
10.001	Mathematics I *or*	4	2	4	4	2	4
10.011	Higher Mathematics I						
17.001	General and Human Biology	2	4	4	2	4	4
		11	13	16½	11	13	16½

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

STAGE 3

2.002	Chemistry IIS	5	3	7	3	7	9
10.031	Mathematics	1	1	2	1	1	2
44.101	Introductory Microbiology	1	2	2	1	2	2
		7	6	11	5	10	13

STAGE 4

3.111	Chemical Engineering Principles I	2	0	2	1	2	2
41.101	Biochemistry	4	8	6	2	0	4
	General Studies Elective	1	½	1	1	½	1
		7	8½	9	4	2½	7

STAGE 5

2.261	Chemistry and Enzymology of Foods	2	4	3½	2	4	3½
3.211	Food Technology I, Part I*	2	4	3½	1	2	2
10.331	Statistics	1	1	1½	1	1	1½
		5	9	8½	4	7	7

* Includes 43.111 Botany

STAGE 6		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
3.212	Food Technology I, Part 2	0	0	0	4	8	7
3.231	Chemical Engineering	2	0	4	2	0	4
44.102A	Nature of Micro-organisms	2	4	4	0	0	0
	General Studies Electives	2	1	2	2	1	2
		6	5	10	8	9	13

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 (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 Department of Food Technology:

3.311 Fuel Engineering I
3.321 Fuel Engineering II
4.011 Metallurgy I
7.311 Mineral Processing I
22.111 Industrial Chemistry I
22.211 Ceramics I
22.311 Polymer Science I
44.101/2 Introductory Microbiology I, Part 2

Any other subject approved by the Professorial Board on the recommendation of the Head of the Department of Food Technology.

* This course is subject to revision.

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.

The undergraduate courses in Polymer Science, described in the 1970 Calendar, have been discontinued. Polymer Science options are now available in the courses in Industrial Chemistry, and students seeking to enrol in these are required to discuss their programmes with the Head of the School.

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.	Pvte. Study
1.031	Physics IAS	3	3	3½
2.001	Chemistry I	2	4	5
10.011 or 10.001	Higher Mathematics I *or* Mathematics I	4	2	4
Plus *one* of:—				
5.001	Engineering I	3	3	4½
17.001	General Biology	3	4	4
25.001	Geology I*	3	4	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
2.311	Physical Chemistry	1½	3	3
2.411	Inorganic Chemistry	1	2	3
2.611	Organic Chemistry	1½	3	3
10.031	Mathematics II	1	1	2
10.331	Statistics	1	1	2
22.111	Industrial Chemistry I	2	2	1
	General Studies Elective	1	½	2
		10½	14	18

* 14 weeks' course.

YEAR 3*		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
2.211	Applied Organic Chemistry	1	3	2½	1	3	2½
3.111	Chemical Engineering Principles I	2	0	2	1	2	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	2	0	0	0
3.311	Fuel Engineering I	1½	½	2	1½	½	2
22.112	Industrial Chemistry II	6	5	11	6	5	11
	Two General Studies Electives	2	1	3	2	1	3
		13½	11½	22½	11½	11½	20½

* 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 Head of School, students may substitute 22.311 Polymer Science I (4-4-8; 2-4-4) 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.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
22.113	Industrial Chemistry III ..	8	5	16	3	1	6
22.121	Industrial Chemistry Seminar	0	2	2	0	2	2
22.191	Project	0	7	4	0	16	4
	General Studies Advanced Elective*	2	0	2	2	0	2
		10	14	24	5	19	14

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.	Pvte. Study
1.031	Physics IAS	3	3	3½
2.001	Chemistry I	2	4	5
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	4
Plus *one* of:—				
5.001	Engineering I	3	3	4½
17.001	General Biology	2	4	4
25.001	Geology I†	2	4	4

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

† 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.	Pvte. Study
1.212	Physics IIT (Unit B)*	1½	1½	2
2.611	Organic Chemistry I	2	2½	3
10.031	Mathematics	1	1	2
10.331	Statistics	1	1	1½
	General Studies Elective	1	½	2
		6½	6½	10½

* 14 weeks' course.

		Hours per week SESSION 1			SESSION 2		
STAGE 4		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
2.311	Physical Chemistry	1½	3	3	1½	3	3
2.411	Inorganic Chemistry	1	2	3	1	2	3
22.111	Industrial Chemistry I	2	2	1	2	2	1
	General Studies Elective	1	½	1½	1	½	1½
		5½	7½	8½	5½	7½	8½
STAGE 5							
3.111	Chemical Engineering Principles I	2	0	2	1	2	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	2	0	0	0
3.311	Fuel Engineering I	1½	½	2	1½	½	2
22.112/1	Industrial Chemistry II, Part I	1½	2½	4	1½	2½	4
		6	5	10	4	5	8

Option: With the approval of Head of School, students may substitute 22.311 Polymer Science I (4-4-8; 2-4-4) 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.

		Hours per week					
		SESSION 1			SESSION 2		
STAGE 6		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
2.211	Applied Organic Chemistry	1	3	2½	1	3	2½
22.112/2	Industrial Chemistry II, Part II	4½	2½	8	4½	2½	8
	General Studies Elective	1	½	1½	1	½	1½
		6½	6	12	6½	6	12

Ceramic Engineering—Full-Time Course
Bachelor of Science

YEAR 1							
1.031	Physics IAS	3	3	3½	3	3	3½
2.001	Chemistry I	2	4	5	2	4	5
5.001	Engineering I	3	3	4½	3	3	4½
10.001 10.011	Mathematics I *or* Higher Mathematics I	4	2	4	4	2	4
		12	12	17	12	12	17

		Hours per week for 2 Sessions		
YEAR 2		Lec.	Lab. Tut.	Pvte. Study
1.212	Physics IIT (Units B and C)	1½	1½	2
2.311	Physical Chemistry	1½	3	3
2.411	Inorganic Chemistry	1	2	3
2.511	Analytical Chemistry	1	3	3
8.112	Materials and Structures	1	2	1½
10.031	Mathematics	1	1	2
10.331	Statistics	1	1	2
	General Studies Elective	1	½	2
		9	14	18½

YEAR 3*		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
3.111	Chemical Engineering Principles I	2	0	2	1	2	2
3.112	Chemical Engineering Material Balances and Thermodynamics*	1	2	2	0	0	0
3.311	Fuel Engineering I	1½	½	2	1½	½	2
22.211	Ceramics I	4	5	8	4	5	8
22.221	Chemical Thermodynamics and Kinetics	1½	1½	3	1½	1½	3
25.201	Mineralogy	1	1	2	1	2	2
	Two General Studies Electives	2	1	4	2	1	4
		13	11	23	11	12	21

* 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	6	3	3	6
22.231	Ceramic Engineering	2	2	4	2	2	4
22.241	Instrumentation Process Control	4	4	5	0	0	0
22.251	Operation Research and Seminars	2	0	2	0	0	0
22.291	Project	0	4	2	0	11	2
	General Studies Advanced Elective*	2	0	4	2	0	4
		11	13	23	7	16	16

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

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

		Hours per week for 2 Sessions		
STAGES 1 and 2*		Lec.	Lab. Tut.	Pvte. Study
1.031	Physics IAS	3	3	3½
2.001	Chemistry I	2	4	5
5.001	Engineering I	3	3	4½
10.011 or 10.001	Higher Mathematics I *or* Mathematics I	4	2	4
		12	12	17

* Two subjects will be taken in the first year and the other two in the second year (as directed).

STAGE 3

1.212	Physics IIT (Units B and C)	1½	1½	2
2.311	Physical Chemistry	1½	3	3
10.031	Mathematics	1	1	2
10.331	Statistics	1	1	2
		5	6½	9

STAGE 4

2.411	Inorganic Chemistry	1	2	3
2.511	Analytical Chemistry	1	3	3
8.112	Materials and Structures	1	2	1½
	General Studies Elective	1	½	2
		4	7½	9½

STAGE 5

22.211/1	Ceramics I (Part I)	2	2	4
22.221	Chemical Thermodynamics and Kinetics	1½	1½	3
25.201	Mineralogy	1	1	2
	General Studies Elective	1	½	2
		5½	5	11

STAGE 6		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
3.111	Chemical Engineering Principles I	2	0	2	1	2	2
3.112	Chemical Engineering Material Balances and Thermodynamics	1	2	2	0	0	0
3.311	Fuel Engineering I	1½	½	2	1½	½	2
22.211/2	Ceramics I (Part II)	2	3	5	2	3	5
	General Studies Elective	1	½	1½	1	½	1½
		7½	6	12½	5½	6	10½

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		
		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
YEAR 1							
2.001	Chemistry 1	2	4	5	2	4	5
10.001 10.011 10.021	Mathematics I *or* Higher Mathematics 1 *or* Mathematics IT	4	2	4	4	2	4
17.001	General and Human Biology	3	3	4	3	3	4
27.001	Applied Geography I*	2	4	4	2	4	4
		11	13	17	11	13	17
YEAR 2							
1.031	Physics IAS	3	3	3½	3	3	3½
27.002	Applied Geography II*	2	4	6	2	4	6
43.101A	Genetics and Biometry	3	3	6	0	0	0
43.101B	Plant Evolution and Ecology	0	0	0	2	4	6
	General Studies Elective	1	½	2	1	½	2
		9	10½	17½	8	11½	17½
YEAR 3							
27.003	Techniques in Physical Geography	0	0	0	1	4	2
27.013	Geographic Methods	0	1½	2	0	1½	2
27.203	Biogeography*	2	3½	6	0	0	0
27.403	Geomorphology and Pedology	2	3½	6	2	3½	6
43.102E	Environmental Botany	2	4	6	0	0	0
43.101C 45.102B	Plant Physiology *or* Animal Behaviour	0	0	0	2	4	6
	Two General Studies Electives	2	1	4	2	1	4
		8	13½	24	7	14	20

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

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

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

		Hours per week					
		SESSION 1			SESSION 2		
YEAR 4		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
27.204	Advanced Biogeography ..	3	6	6	0	0	0
27.333	Agricultural Geography*	2	3½	5	0	0	0
27.504	Project (Biogeography)	0	2	2	0	10	0
	General Studies Advanced Elective	1	½	4	1	½	4
		6	12	17	1	10½	4

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

		Hours per week for 2 Sessions		
GEOMORPHOLOGY AND PEDOLOGY				
YEAR 1		Lec.	Lab. Tut.	Pvte. Study
2.001	Chemistry I	2	4	5
10.001 10.011 10.021	Mathematics I *or* Higher Mathematics I *or* Mathematics IT	4	2	4
17.001	General and Human Biology	3	3	4
27.001	Applied Geography I*	2	4	4
		11	13	17

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

YEAR 2				
1.031	Physics IAS	3	3	3½
25.001	Geology I*	3	3	4
27.002	Applied Geography II*	2	4	6
	General Studies Elective	1	½	2
		9	10½	15½

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

YEAR 3*		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
25.002	Geology II	5	4	6	4	5	6
27.003	Techniques in Physical Geography	0	0	0	1	4	2
27.013	Geographic Methods	0	1½	0	0	1½	0
27.203	Biogeography	2	3½	5	0	0	0
27.403	Geomorphology and Pedology	2	3½	5	2	3½	5
	Two General Studies Electives	2	1	4	2	1	4
		11	13½	20	9	15	17

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

YEAR 4							
8.245	Soil Mechanics	1	1	1½	1	1	1½
25.013	Geology III (Supplementary)*	2	2	3	2	2	3
27.404	Advanced Geomorphology and Pedology	3	6	6	0	0	0
27.504	Project (Geomorphology and Pedology)	0	2	2	0	10	0
	General Studies Advanced Elective	1	½	4	1	½	4
		7	11½	16½	4	13½	8½

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

ECONOMIC GEOGRAPHY

YEAR 1		Hours per week for 2 Sessions Lec.	Lab. Tut.	Pvte. Study
10.001 10.011 10.021	Mathematics I *or* Higher Mathematics I *or* Mathematics IT	4	2	4
15.101	Economics I	2	1	3
53.121	Sociology IT	2	2	4
27.001	Applied Geography I*	2	4	4
		10	9	15

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

YEAR 2		Hours per week for 2 Sessions Lec.	Lab. Tut.	Pvte. Study
15.102	Economics II	2	2	4
27.002	Applied Geography II*	2	4	6
28.101	Principles of Marketing	2	0	3
28.102	Case Studies in Marketing	2	0	3
		8	6	16

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

YEAR 3		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
15.103	Economics III	1	1	3	1	1	3
15.243 / 15.263	Economic Development *or* International Economics	1	1	2	1	1	2
15.402	Econometric Methods	2	1	4	2	1	4
27.303	Urban and Transport Geography*	0	0	0	2	3½	5
27.313	Location Theory*	2	3½	5	0	0	0
27.323	Marketing Geography*	0	0	0	2	3½	5
27.333	Agricultural Geography*	2	3½	5	0	0	0
27.013	Geographic Methods	0	1½	0	0	1½	0
		8	11½	19	8	11½	19

* 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 (1971 only)							
11.471	Planning Law and Administration	2	0	2	2	0	2
15.103	Economics III	1	1	3	1	1	3
15.243	Economic Development	1	1	2	1	1	2
27.304	Advanced Economic Geography	2	3	8	0	0	0
27.504	Project (Economic Geography)	0	2	6	0	10	0
		6	7	21	4	12	7

		Hours per week					
		SESSION 1			SESSION 2		
YEAR 4 (from 1972)		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
11.471	Planning Law and Administration*	2	0	2	2	0	2
27.304	Advanced Economic Geography	2	3	6	0	0	0
27.504	Project (Economic Geography)	0	3	6	0	10	0
12.001	Psychology I *or*	3	2	4	3	2	4
51.111	History I *or*	2	1	3	2	1	3
53.121	Sociology IT** *or*	2	2	4	2	2	4
54.111	Political Science I	2½	2	3	2½	2	3

* Students enrolled in 1969 may substitute 28.102 Case Studies in Marketing.
** 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 may choose from a wide range of different types of employment with a great choice of 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. Conse-

quently, 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		
YEAR 1		Lec.	Lab. Tut.	Pvte. Study
1.031	Physics IAS	3	3	3½
2.001	Chemistry I	2	4	5
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	4
Plus one of				
5.001	Engineering I	3	3	4½
25.001	Geology I	2	4	4

YEAR 2		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
2.022	Chemistry II (M)	3	4	7	2	3	5
4.011	Metallurgy I*	5	5	8	5	6	8
4.031	Physics of Metals†	1	3	2	1	0	2
10.031	Mathematics	1	1	2	1	1	2
5.001	Engineering I, Part A *or*	2	0	2	2	0	2
25.201	Mineralogy	1	1	2	1	1	2
	General Studies Elective	1	½	2	1	½	2
		12/13	13½/14½	23	11/12	10½/11½	21
*From Week 12 in Session 1		5	6	8			
†From Week 12 in Session 1		1	0	2			

YEAR 3		Hours per week for 2 Sessions Lec.	Lab. Tut.	Pvte. Study
4.012	Metallurgy II*	9	10	17
4.041	Mathematical Methods† *or*	2½	½	2
6.801	Electrical Engineering	1	2	2
	Two General Studies Electives	2	1	4
		12/13½	11½/13	23
*From Week 12 in Session 1		9	11	17

YEAR 4				
4.013	Metallurgy III*	6	11	13½
4.021	Metallurgy Project†	0	5	5
	General Studies Advanced Elective	1	½	2
		7	16½	20½
*From Week 12 in Session 1		6	8	13
From Week 5 in Session 2		6	0	12
†From Week 12 in Session 1		0	10	10

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.	Pvte. Study
1.031	Physics IAS	3	3	3½
2.001	Chemistry I	2	4	5
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	4
Plus one of				
5.001	Engineering I	3	3	4½
25.001	Geology I	2	4	4
		11/12	12/13	16½/17

* 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.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
2.022	Chemistry II (M)	3	4	5	2	3	5
4.031	Physics of Metals*	1	3	2	1	0	2
10.031	Mathematics	1	1	2	1	1	2
	General Studies Elective	1	½	2	1	½	2
		6	8½	11	5	4½	11
*From Week 12 in Session 1		1			0		2

STAGE 4		Hours per week for 2 Sessions Lec.	Lab. Tut.	Pvte. Study
4.011	Metallurgy 1*	5	5	8
25.201	Mineralogy *or*	1	1	2
5.001	Engineering I (Part A)	2	0	2
		6/7	5/6	10
	*From Week 12 in Session 1	5	6	8

STAGE 5		Hours per week for 2 Sessions Lec.	Lab. Tut.	Pvte. Study
4.012/1	Metallurgy IIA	4	5	8
6.801	Electrical Engineering *or*	1	2	2
4.041	Mathematical Methods	2	½	2
	General Studies Elective	1	½	2
		6/7	6/7½	12

STAGE 6				
4.012/2	Metallurgy IIB	5	6	10
	General Studies Elective	1	½	2
		6	6½	12

Metallurgy B.Sc. (Tech.) in Full-Time/Part-Time Study*

Students enrolling in the Metallurgy 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 (as set out below)

STAGE 5A		Hours per week for 2 Sessions Lec.	Lab. Tut.	Pvte. Study
4.012/3	Metallurgy IIC	2	2	3½
4.013/1	Seminar	0	1	1
4.012/4	Report	0	0	2
		2	3	6½

* 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 (Grad.Dip.) in Mining Engineering or Mineral Technology.

Part-time courses in Mining Engineering and Mineral Processing, leading to the award of the B.Sc. (Tech.) degree, 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 B.Sc. (Tech.) 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 than it has been in the past. 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 on estab-

lished mining fields. 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 Geology and Geophysics, 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 an elective subject is offered in the final year of the course. In addition, during the final year of the course students are given a project linked with the elective for which a thesis must be submitted.

During the undergraduate course, students will spend portion of the long recesses obtaining practical experience in mines. The minimum requirement is 100 days' industrial experience, fifty working days in each of Years 2 and 3. However, students are advised to seek additional practical training. 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.	Pvte. Study
1.001 1.031	Physics I *or* Physics IAS	3	3	3½
2.001	Chemistry I	2	4	5
5.001	Engineering I	3	3	4½
10.011 10.001	Higher Mathematics I *or* Mathematics I	4	2	4
		12	12	17

YEAR 2		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
4.941	Materials	0	0	0	1	1	2
5.711	Thermodynamics	0	0	0	1	1	2
6.801	Electrical Engineering	1	2	3	1	2	3
7.110	Mineral Resources Parts 1 & 2	1	0	1	1	0	1
8.151	Mechanics of Solids	2	1	3	2	1	3
8.250	Properties of Materials	2	2	3	0	0	0
8.510	Hydraulics	2	2	3	0	0	0
10.022	Mathematics	2	2	4	2	2	4
25.101	Geology for Engineers*	0	0	0	2	2	2
29.441	Engineering Surveying†	1½	1½	2	1½	1½	2
	General Studies Elective	1	½	2	1	½	2
		12½	11	21	12½	11	21

* Two one-day Geology excursions are an essential part of the course.
† 29.491 Survey Camp is an essential part of this subject.

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.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
7.111	Mining Engineering I Parts 1 and 2	4	4	8			
7.121	Mine Surveying and Control Engineering	1	1	1½			
7.551	Mining and Mineral Process Engineering Parts 1 and 2	2	2	2			
25.102	Geology for Mining Engineers*	4	3	6			
	Two General Studies Electives	2	1	5			
		13	11	22½			

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

Note: In the recess between Sessions 1 and 2 and during the whole of Session 2, 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							
7.112	Mining Engineering II*	3	3	6	3	3	6
7.113	Mineral Industry Elective Project*	0	5	4	0	5	4
7.115 / 7.315	Mining Engineering III *or* Mineral Processing II	1	3	3	0	0	0
7.116 / 7.316	Mining Engineering IV *or* Mineral Processing III	0	0	0	1	3	3
7.132	Mine Valuation	1	1	2	0	0	0
7.133	Mineral Economics	0	0	0	1	1	2
7.311	Mineral Processing I*	2	4	6	2	4	6
	General Studies Advanced Elective	2	0	4	2	0	4
		9	16	25	9	16	25

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

Mining Engineering—Part-Time Course

Bachelor of Science (Technology)

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

The School of Mining Engineering offers part-time courses in Mining Engineering and Mineral Processing, leading to the degree of Bachelor of Science (Technology).

STAGES 1 and 2		Hours per week for 2 Sessions Lec.	Lab. Tut.	Pvte. Study
1.001 / 1.031	Physics I *or* Physics IAS	3	3	3½
2.001	Chemistry I	2	4	5
5.001	Engineering I	3	3	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	4
		12	12	17

STAGE 3		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
4.941	Materials	1	1	2	0	0	0
7.110/1	Mineral Resources Parts 1 and 2	1	0	1	1	0	1
8.151	Mechanics of Solids	2	1	3	2	1	3
8.250	Properties of Materials	0	0	0	2	2	3
10.022	Mathematics II Parts 1 and 2	2	2	4	2	2	4
		6	4	10	7	5	11

STAGE 4		Hours per week for 2 Sessions Lec.	Lab. Tut.	Pvte. Study
5.611	Fluid Mechanics/Thermodynamics	2	2	4
7.551/1	Mining and Mineral Process Engineering, Parts 1 and 2*	1	1	2
	General Studies Elective	1	½	2
29.441	Engineering Surveying†	1½	0	2
25.101	Geology for Engineers‡	1	1	2
		6½	4½	12

* 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.	Pvte. Study
6.801	Electrical Engineering	1	2	3
7.111/1	Mining Engineering I—Parts 1 & 2	2	2	4
7.121/1	Mine Surveying and Control Engineering	1	0	1½
25.102/1	Geology for Mining Engineers*	2	2	3
	General Studies Elective	1	½	1
		7	6½	12½

* Geology excursion will be conducted during the year.

STAGE 6				
7.112/1	Mining Engineering II*	3	2	5
7.113/1	Mineral Industry Elective Project†	0	2	3
7.311/1	Mineral Processing I	1	2	2
	General Studies Elective	1	½	1
		5	6½	11

* 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.

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 Technolgy. A minimum of three years' concurrent industrial training in approved industries is required before graduation.

STAGES 1 and 2*				
1.001 / 1.031	Physics I *or* Physics IAS	3	3	3½
2.001	Chemistry I	2	4	5
5.001	Engineering I	3	3	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	4
		12	12	17

* 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.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
2.311	Physical Chemistry I	1½	3	3	1½	3	3
4.941	Materials	1	1	2	0	0	0
8.250	Properties of Materials	0	0	0	2	2	3
10.022	Mathematics Parts 1 and 2	2	2	4	2	2	4
	General Studies Elective	1	½	2	1	½	2
		5½	6½	11	6½	7½	12

STAGE 4		Hours per week for 2 Sessions		
2.511	Analytical Chemistry I	1	3	3
7.551/1	Mining and Mineral Process Engineering Parts 1 and 2*	1	1	2
10.331	Statistics	1	1	2
25.101/1	Geology for Engineers†	1	1	2
25.201	Mineralogy	1	1	2
		5	7	11

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

STAGE 5*				
6.801	Electrical Engineering ..	1	2	2
7.411	Fluid Mechanics	1	1	2
7.311	Mineral Processing I Parts 1 and 2	3	3	6
	General Studies Elective	1	½	2
		6	6½	12

* Available in 1972.

STAGE 6*				
7.113/1	Mineral Industry Elective Project, Parts 1 and 2†	0	2	3
7.312	Mineral Processing II	3	4	6
7.412	Mineral Industry Processes, Parts 1 and 2	1	1	2
	General Studies Elective	1	½	2
		5	7½	13

* 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		Lec.	Lab. Tut.	Pvte. Study
1.031	Physics IAS*	3	3	3½
2.001	Chemistry I	2	4	5
5.001	Engineering I	3	3	4½
10.011 10.001	Higher Mathematics I *or* Mathematics I	4	2	4
		12	12	17

* 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
2.002	Chemistry II	3	6	6
10.331	Statistics	1	1	1½
13.111	Textile Technology I	3	5	5
13.211	Textile Science I	2	1	4
	General Studies Elective	1	½	2
		10½	14½	20½
YEAR 3				
2.003A 2.003B	Chemistry III Chemistry III	2	4	3½
13.112	Textile Technology II	6	7	10
13.212	Textile Science II	1	0	3
13.311	Textile Engineering I	1	0	1½
	Two General Studies Electives	2	1	4
		12	12	22

TEXTILE PHYSICS

		Hours per week for 2 Sessions		
YEAR 2		Lec.	Lab. Tut.	Pvte. Study
1.112	Physics II	4	3	4
10.111	Pure Mathematics II	3	2	4
10.331	Statistics	1	1	1½
13.111	Textile Technology I	3	5	5
13.211	Textile Science I	2	1	4
	General Studies Elective	1	½	2
		14	12½	20½
YEAR 3				
1.213	Textile Physics III	4	3	5
13.112	Textile Technology II	6	7	10
13.212	Textile Science II	1	0	2
13.311	Textile Engineering I	1	0	1½
	Two General Studies Electives	2	1	4
		14	10	22½

TEXTILE ENGINEERING

YEAR 2				
5.301	Engineering Mechanics	1½	½	2
5.611/1	Fluid Mechanics	1	1½	2
8.112	Materials and Structures	1	2	1½
10.031	Mathematics	1	1	2
10.331	Statistics	1	1	2
13.111	Textile Technology I	3	5	5
13.211	Textile Science I	2	2	4
	General Studies Elective	1	½	2
		11½	13½	20½
YEAR 3				
5.101/1	Mechanical Engineering Design	0	2	1
5.331	Dynamics of Machines	2	1	2
6.801	Electrical Engineering	1	2	2
13.112	Textile Technology II	6	7	10
13.212	Textile Science II	1	0	2
13.311	Textile Engineering I	1	0	1½
	Two General Studies Electives	2	1	4
		13	13	22½

TEXTILE MANUFACTURE

		Hours per week for 2 Sessions		
YEAR 2		Lec.	Lab. Tut.	Pvte. Study
10.331	Statistics	1	1	2
12.101	Psychology	3	0	2
13.111	Textile Technology I	3	5	5
13.211	Textile Science I	2	2	4
14.111	Accounting I	2	2	4
15.101	Economics I	2	1	3
	General Studies Elective	1	½	2
		14	11½	22
YEAR 3				
13.112	Textile Technology II	6	7	10
13.212	Textile Science II	1	0	2
13.311	Textile Engineering I	1	0	1½
14.321	Business Finance	2	0	3
26.122S	Psychology	1½	½	2
28.101	Principles of Marketing	2	0	3
	General Studies Elective*	1	½	2
		14½	8	23½
YEAR 4				
13.113	Textile Technology III	5	3	8
13.213	Textile Science III	2	4	6
13.312	Textile Engineering II	1½	0	3
13.411	Project	0	7	2
	General Studies Advanced Elective	2	0	4
		10½	14	23

* Not to include Economics or Psychology.

SCHOOL OF WOOL AND PASTORAL SCIENCES

To meet 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). (Courses in Wool Commerce leading to the degree of Bachelor of Commerce are offered in the Faculty of Commerce). The School also offers a course at the graduate level requiring one year of full-time or two years of part-time study leading to the Graduate Diploma in Wool and Pastoral Sciences, and there are further courses leading to the research 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.

From time to time obligatory excursions, farm tours, 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.

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 sheep 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

YEAR 1		Hours per week for 2 Sessions Lec.	Lab. Tut.	Pvte. Study
2.001	Chemistry I	2	4	5
10.011 10.001 10.021	Higher Mathematics I *or* Mathematics I *or* Mathemtics IT	4	2	4
17.001	General and Human Biology	2	4	4
27.001	Geography*	2	4	4
		10	14	17

* 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	3
9.221	Agronomy	2	2	4
9.411	Agricultural Chemistry I	1	3	2
9.531	Wool Technology I	2	6	4
9.601	Animal Physiology I	2	3	3
10.331	Statistics	1	1	2
	General Studies Elective	1	½	2
		12	15½	20

YEAR 3		Hours per week SESSION 1 Lec.	Lab. Tut.	Pvte. Study	SESSION 2 Lec.	Lab. Tut.	Pvte. Study
9.131	Animal Health and Preventive Medicine I	0	0	0	2	1	4
9.231	Pastoral Agronomy	1	1	2	2	2	4
9.311	Agricultural Economics I	2	0	4	0	0	0
9.801	Genetics I	2	0	3	2	1	4
41.101	Biochemistry I	4	8	8	2	4	4
	Two General Studies Electives	2	1	4	2	1	4
		11	10	21	10	9	20

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

		Hours per week SESSION 1			SESSION 2		
		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
9.122/1	Livestock Production II	2	0	4	0	0	0
9.122/2	Livestock Production II	0	0	0	2	0	4
9.232	Crop Agronomy	0	0	0	2	0	4
9.312	Agricultural Economics II	0	0	0	2	0	4
9.313	Farm Management I	2	0	4	0	0	0
9.314	Farm Management IIA *or*	0	0	0	2	0	4
9.316	Analysis of Rural Development Projects						
9.532/1	Wool Technology II (Wool Study)	0	2	1	0	2	1
9.532/2	Wool Technology II (Wool Metrology)	1	2	2	1	2	2
9.532/3	Wool Technology II (Raw Materials)	0	0	0	2	0	4
9.602	Animal Physiology II	2	0	4	2	0	4
YEAR 4							
9.001	Project	0	6	0	0	5	0
9.811	Biostatistics	2	2	4	2	2	4
	General Studies Advanced Elective	1	½	2	1	½	2

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	2	1	1	2
9.132	Animal Health and Preventive Medicine II	2	1	4	0	0	0
9.232	Crop Agronomy	0	0	0	2	0	4
9.412	Agricultural Chemistry II	2	4	4	2	4	4
9.421	Animal Nutrition	3	0	4	0	0	0
9.533	Wool Technology III	1	1	1	1	1	1
9.534	Wool Technology IV	2	2	2	2	2	2
9.603	Animal Physiology III	2	2	4	2	2	4
9.802	Genetics II	2	2	4	2	2	4
9.901	Rural Extension	2	2	4	2	2	4
9.312	Agric. Economics II	0	0	0	2	0	4
9.313	Farm Management I	2	0	4	0	0	0
9.314	Farm Management IIA	0	0	0	2	0	4
9.315	Farm Management II B	2	0	4	0	0	0
9.316	Analysis of Rural Development Projects	0	0	0	2	0	4
43.101C	Plant Physiology	0	0	0	2	4	4
43.102E	Environmental Botany	2	4	4	0	0	0

TABLE OF PROGRESSION IN SUBJECTS

Year 1		Year 2		Year 3		Year 4	
27.001	Geography I	9.221	*Agronomy*	9.231	*Pastoral Agronomy*	9.232 43.101C 43.102E	Crop Agronomy Plant Physiology Environmental Botany
17.001	*General and Human Biology*	9.601 9.101	*Animal Physiology I* *Livestock Production I*	9.602 9.122/1 9.122/2 9.131	Anim. Physiol. II L'stck Prodn. II L'stck Prodn. II *Animal Health and Prev. Medicine I*	9.603 9.421 9.123 9.132	Anim. Physiol. III Anim. Nutrition L'stock Prodn. III Anim. Health and Prev. Medicine II
2.001	*Chemistry I*	9.411	*Agricultural Chemistry I*	41.101	*Biochemistry I*	9.412	Agric. Chemistry II
10.021 10.011 10.001	*Mathematics I*	10.331	*Statistics*	9.801	*Genetics I*	9.811 9.802	*Biostatistics* Genetics II
				9.311 9.312 9.313 9.314 9.316	*Agricultural Economics I* Agricultural Economics II Farm Management I Farm Management IIA Analysis of Rural Development Projects	9.312 9.313 9.314 9.315 9.316 9.901	Agric. Economics II Farm Management I Farm Management IIA Farm Management IIB Analysis of Rural Development Projects Rural Extension
1.031 1.011 1.001	Physics I	9.531	*Wool Technology I*	9.532/1 9.532/2 9.532/3	Wool Technology II Wool Technology II Wool Technology II	9.533 9.534	Wool Technology III Wool Technology IV

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.

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 and Pastoral Sciences.

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 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, whether full-time or part-time and the course in which the applicant wishes to enrol, state 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 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 (13th August, 1971).

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 $6

(ii) Graduation Fee $8

(iii) Course Fee — calculated on the basis of a session's attendance at the rate of $10.50 per hour per week.

Thus the fee for a programme requiring an attendance of 24 hours per week for the session is 24 x $10.50 = $252 per session.

(iv) Thesis or Project Fee—$42 (an additional fee of $28* 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).

(b) Graduate Diploma Courses

(i) Registration Fee $6

(ii) Award of Diploma Fee $8

(iii) Course Fee — calculated on the basis of a session's attendance at the rate of $10.50 per hour per week.

Thus the fee for a programme requiring an attendance of 24 hours per week for the session is 24 x $10.50 = $252 per session.

(iv) Thesis or Project Fee—$42 (an additional fee of $28* 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).

(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 $10.50 per hour per week. Thus the fee for a subject requiring an attendance of 2 hours per week for the sessions is 2 x $10.50 = $21.00 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, $14.

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.

Student Activities Fees—

University Union†—$20—annual subscription.
Sports Association†—$4—annual subscription.
Students' Union†—$5—annual subscription.
Miscellaneous—$17—annual fee.

Examinations conducted under special circumstances—$8 for each subject.

Review of examination result—$8 for each subject.

Late Fees

First Session

Fees paid from commencement of third week of the session to March 31	$14
Fees paid after March 31 where accepted with the express approval of the Registrar (see above)	$28

Second Session

Fees paid in third and fourth weeks of the session	$14
Fees paid thereafter	$28
Late lodgement of corrected enrolment details form (Late applications will be accepted for three weeks only after the prescribed dates.)	$6

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—$5 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 $2, 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	$14
(ii)	Registration Fee	$6
(iii)	Internal full-time student annual fee	$84
	Internal full-time student session fee	$42
(iv)	Internal part-time student annual fee	$42
	Internal part-time student session fee	$21
(v)	External student annual fee†	$28
(vi)	Final Examination (including Graduation Fee)	$42

* Candidates registered under the conditions governing the award of this degree without supervision will pay the following fees; Registration fee $6; Examination of thesis $84. 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	$14
(ii) Registration Fee	$6
(iii) Annual Fee	$84
(iv) Final Examination (including Graduation Fee)	$57

(c) Doctor of Science

(i) Registration Fee	$88

(d) Research Degree

Continuation Fee*	$28

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 $28. 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 $10.50 per hour per week. Thus the fee for a subject requiring an attendance of 2 hours per week for the session is 2 x $10.50 = $21 per session.

Research

One day per week—$28 per annum.

Two or three days per week—$55 per annum.

Four or five days per week—$84 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.

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, $14.

University Union—$20—entrance fee.

Student Activities Fees—

University Union†—$20—annual subscription.

Sports Association†—$4—annual subscription.

Students' Union†—$5—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 $14

Renewal at Commencement of each Academic Year

Fees paid from commencement of third week of Session 1. to March 31 .... $14

Fees paid after March 31 where accepted with the express approval of the Registrar $28

† 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 stipends for all scholarships range from $2,350-$2,600 per annum for scholars without dependants to $2,800-$3,250 per annum for a scholar wholly maintaining a wife and one or more 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 Research and Formal Course 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.

Atmospheric Pollution Research Fellowships

Fellowships for research on atmospheric pollution, having an annual value of $2,350-$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 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 $2,500*, 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.

G. J. Coles & Co. Ltd. Research Scholarship in Engineering, Science or Applied Science

This scholarship is available to graduates or graduands of any Australian University domiciled in Australia who wish to undertake post-graduate study and research leading to the degree of Doctor of Philosophy in the Faculties of Engineering, Science or Applied Science. It carries an annual stipend of $2,500*, and is tenable for one to four years.

* This stipend is under review.

The Imperial Chemical Industries of Australia and New Zealand Research Fellowship

Imperial Chemical Industries of Australia and New Zealand has established a Fellowship to help promote knowledge in fields which have a direct relation to the scientific interests of ICIANZ, such as pure and applied chemistry, biochemistry, agricultural science, chemotherapy, pharmacology, physics, engineering, mining and metallurgy. The Fellowship is open to British subjects who are graduates of a recognized University. It has an annual value of $2,500*, and is tenable for two years.

Broken Hill Associated Smelters Pty. Ltd.

A number of scholarships are made available each year to enable graduates or diplomates in Metallurgy or an allied science to undertake postgraduate work connected with the donor Company's activities. The maximum tenure of the scholarship is three years. Applications should be made to Broken Hill Associated Smelters Pty. Ltd., Port Pirie, S.A.

The General Motors-Holden's Postgraduate Research Fellowships

General Motors-Holden's Limited has agreed to provide annually eight post-graduate research fellowships. 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.

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 up to a maximum of four years subject to annual renewal.

Australian Wool Board Research Scholarships in Wool and Pastoral Sciences—Wool Production

Scholarships provided by the Australian Wool Board are available for graduates in Applied Science, Science, Agricultural

* This stipend is under review.

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 up to 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.

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 12th September.

C.S.I.R.O. Studentships

Studentships have a value of $2,500-$2,800 per annum, plus compulsory university fees, and an annual $500 grant-in-aid to the University. Duration of awards up to a maximum of four years. Applications to be lodged with the Secretary, Studentship Selection Committee, C.S.I.R.O., P.O. Box 89, East Melbourne, Victoria, 3002, by 7th November.

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.

* Exempt University tuition fees.

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.

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 Meat Research Committee

The range of value of the awards is $2,500 to $2,800 p.a. (two years, with possible extension for a further two years for study leading to the degree of Doctor of Philosophy), plus fees and certain allowances. Applications to the Secretary, C.S.I.R.O., 314 Albert Street, East Melbourne, Vic., 3002, by 31st July.

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. An allowance of $450 p.a. may be paid for a dependent wife and child (or children). Applications should be lodged with Conzic Riotinto of Aust. Ltd., Box 384D, Melbourne, Victoria, 3001, by 31st December.

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 with possible extensions up to four years. Applicants must possess or expect to possess by the beginning of the 1971 academic year a 1st or 2nd Class Honours Degree or a Master's Degree in Science, Engineering or Mathematics. Commencing salary—2nd Class Honours Degree $4,242; 1st Class Honours Degree $4,500; Master's Degree $4,996. Compulsory fees are paid by the Department. A bond of service is required. Studentships will be advertized in the daily press late in November. Applications should be lodged with Secretary, Department of Supply, Canberra, A.C.T., 2600.

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 arrangements will be made for staff from the schools of the Faculty of Applied Science to participate in this activity 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, which is of such importance to the world.

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.

FULL-TIME COURSE

		Hours per week for 2 Sessions		
		Lec.	Lab. Tut.	Pvte. Study
8.557G	Engineering Hydrology	1½	1½	3
8.558G	Groundwater Hydrology	1½	1½	3
25.401G	Groundwater Investigations	1½	1½	3
25.402G	Hydrogeology	1½	1½	3
25.403G	Project	0	9	10
27.901G	Geomorphology for Hydrologists	1	2	2
		7	17	24

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.

FULL-TIME COURSE

		Hours per week for 2 Sessions	
		Lec./Lab.	Pvte. Study
6.168G	Potential and Systems Theory in Geophysics	2	4
6.841	Electronic Instrumentation	2	4
29.441	Engineering Surveying	1½	1½
10.331	Statistics†	1½	2
25.111G	Geology	4	3
25.321G	Geophysics	6	12
		17½	26½

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

SCHOOL OF CHEMICAL ENGINEERING

Chemical Engineering Projects

As part of his course work each student will undertake a project on a topic to be approved by the Higher Degree Committee of the Faculty of Applied Science. It is understood that the project will integrate and apply the principles treated in the course, and that it may take the form of a design feasibility study or an experimental investigation. In all cases evidence of initiative and of a high level of ability and understanding will be sought in the student's approach to the project.

The work carried out will be embodied in a thesis and submitted in accordance with the University requirements for the Master of Applied Science thesis.

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 who will specialise in the application of advanced engineering principles to solve 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.

FULL-TIME COURSE

		Hours per week for 2 Sessions	
		Lec./Lab.	Pvte. Study
3.461G	Physical Transport Processes	2	4
3.462G	Thermodynamics and Theory of Rate Processes	1	2
3.463G	Bioprocess Dynamics and Plant Design	3	3
3.464G	Continuous Culture Processes	1	2
42.201G	Theoretical Biology	1	2
42.202G	Microbiology and Biochemistry	8	12
3.900G	Project	–	–
		16	25

Chemical Engineering Graduate Course* (Master of Applied Science)

The graduate course in Chemical Engineering provides a comprehensive study of the theoretical and practical aspects of reactor engineering. It leads to the degree of Master of Applied Science and extends over one full-time year. The course is primarily intended for candidates who have successfully completed a four year degree programme in chemical engineering and is not intended to be undertaken by graduates in other disciplines unless they have met the appropriate pre-requisites.

Admission Procedure

Intending applicants should notify the School of their intention to enrol, if possible, before 30th November of the year preceding the one in which admission is sought. No application will be considered unless received before 1st February in the proposed year of enrolment.

* This course is under revision and will not be offered in 1971. The new course will embody a more flexible structure with a wider choice of electives.

FULL-TIME COURSE

		Hours per week for 2 Sessions	
		Lec./Lab.	Pvte. Study
3.181G	Advanced Process Dynamics	1	2
3.182G	Process Optimization	1	2
3.183G	Thermodynamics, Kinetics and Mechanism	2	4
3.184G	System Simulation and Control	2	4
3.185G	Interphase Mass Transfer	1	2
3.186G	Transport Phenomena	1	2
3.187G	Design	1	2
3.190G	Specialist Lectures	1	2
	Graduate Electives	2	4
3.900G	Projects	–	–
		12	24

Graduate Electives

Students may select one subject from the following list.

		Hours per week	
		Lec./Lab.	Pvte. Study
3.170G	Process Principles	2	6
3.171G	Corrosion Technology I	2	4
3.174G	Corrosion Technology II	2	4
3.188G	Advanced Chemical Engineering Economics	2	1
3.241G	Food Technology	4	7
3.390G	Postgraduate Fuel Technology Seminar	1	2
3.391G	Atmospheric Pollution and Control	2	2
3.392G	Fuel Science	3	4
3.393G	Fuel Engineering Plant Design	3	5
3.394G	Thermal Engineering and Fuel Processing	3	5
3.395G	Research Techniques and Extension Methods	2	3
3.481G	Heat Mass and Momentum Transfer	2	4
3.482G	Thermodynamics of Biological Systems	1	2
3.483G	Chemical Plan, Design and Operation	5	7

The above list of subjects will be periodically reviewed and will be extended as further graduate courses are introduced.

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 course provides a comprehensive study of the theoretical and practical aspects of the control of gaseous, liquid and solid refuse from industrial plants.

The advent of new laws governing the disposal of liquid effluents into waters, gaseous effluents into the atmosphere and solid refuse on the countryside, will make the problems of industry more acute as industrial processes are developed and expanded. It is evident that special attention must be devoted to the disposal of effluents and refuse and this course is intended to cover the problems in environmental engineering which may be encountered by industrial plants.

As part of his course work each student will undertake a project on a topic to be approved by the Higher Degree Committee of the Faculty of Applied Science. It is understood that the project will integrate and apply the principles treated in the course, and it may take the form of a design feasibility study or an experimental investigation. In all cases evidence of initiative and of a high level of ability and understanding will be sought in the student's approach to the project.

The work carried out will be embodied in a thesis and submitted in accordance with the University requirements for the Master of Applied Science thesis.

FULL-TIME COURSE

		Lec./Lab.	Pvte. Study
3.170G	Process Principles or Graduate Elective*	2	4
3.161G	Meteorological and Hydrological Principles	1	2
3.162G	Urban Pollution and Planning	1	1
3.163G	Industrial Use and Re-use of Water	1	2
3.164G	Medical and Legislative Aspects	1	2
3.166G	Trade Waste Disposal	1	2
3.242G	Treatment of Biological Effluents	2	4
3.391G	Atmospheric Pollution and Control	2	2
44.111	Microbiology	3	2
	Optional Electives†	3	3
3.900G	Project	0	0
		14/17	21/24

* Chemical Engineering/Industrial Chemistry graduates will undertake the elective.

† Graduates taking the optional elective will undertake a (minor) theoretical project.

Science graduates who have passed a second year Chemistry subject will undertake:

3.170G Process Principles—1 hr./wk.
Elective—1 hr./wk.

Graduates who have passed only a first year Chemistry subject will undertake:

3.170G Process Principles—2 hrs./wk.

All electives are subject to approval by the Head of School.

Corrosion Technology Graduate Course (Graduate Diploma)

This Graduate Diploma course is designed for graduates in Applied Science, Engineering and Science who may be faced with corrosion problems in industry.

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, will be specified.

Two years of study on a part-time basis are required for the completion of this course which leads to the Graduate Diploma in Corrosion Technology (Grad. Dip.).

		Hours per week for 2 Sessions	
YEAR 1—PART-TIME		Lec./Lab.	Pvte. Study
3.171G	Corrosion Technology I	3	6
3.170G	Process Principles *or*	2	6
3.172G	Corrosion Laboratory	2	4
		5	10/12

YEAR 2—PART-TIME			
3.173G	Corrosion Materials	2	4
3.174G	Corrosion Technology II	3	6
3.175G	Seminar	1	1
3.176G	Corrosion Literature Review	2 weekly equivalent	
3.177G	Testing Laboratory (by roster)	2 weekly equivalent	

Chemical Engineering graduates will undertake:

3.172G Corrosion Laboratory

Science graduates who have passed a second year Chemistry subject will undertake:

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

NOTE: Part only of each of these two subjects to be taken. Details to be specified.

Graduates who have passed only a first year Chemistry subject will undertake 3.170G Process Principles.

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:

FULL-TIME COURSE

		Hours per week for 2 Sessions	
		Lec./Lab.	Pvte. Study
2.271G	Chemistry and Analysis of Foods	3	3
3.231	Chemical Engineering	2	4
3.241G	Food Technology	4	7
42.201G	Principles of Biology	1	1
42.202G	Principles of Biochemistry	2½	3
42.203G	Biochemical Methods	1½	2
42.204G	Microbial Processes	1	1
44.111	Microbiology	3	4
		18	25

Students who have successfully completed 3.211 and 3.212 Food Technology towards the award of a degree must substitute an approved undergraduate programme of an equivalent number of hours.

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. It involves the following programme:

FULL-TIME COURSE

		Hours per week for 2 Sessions	
		Lec./Lab.	Pvte. Study
A. *Introductory Stage (up to nine hours per week)*			
3.381	Principles of Fuel Technology	3	4
3.382	Combustion Engineering	3	4
3.383	Fuel Plant Evaluation and Assignments	3	4
		9	12
B. *Advanced Stage (up to nine hours per week)*			
3.390G	Post-graduate Seminar	1	2
	Advanced Electives*	8	13
		9	15

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

3.391G	Atmospheric Pollution and Control	2	2
3.392G	Fuel Science	3	4
3.393G	Fuel Engineering Plant Design	3	5
3.394G	Thermal Engineering and Fuel Processing	3	5
3.395G	Research Techniques and Extension Methods	2	3

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

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 (Grad. Dip.). 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		
		Lec.	Lab. Tut.	Pvte. Study	Lec.	Lab. Tut.	Pvte. Study
YEAR 1—PART-TIME							
22.321G	Polymer Engineering I	2	5	4	2	0	4
22.331G	Polymer Chemistry I	2	0	4	2	5	4
		4	5	8	4	5	8
YEAR 2—PART-TIME							
22.322G	Polymer Engineering II	2	0	4	2	5	4
22.332G	Polymer Chemistry II ..	2	5	4	2	0	4
		4	5	8	4	5	8

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.

SCHOOL OF MINING ENGINEERING

The School offers two post-graduate courses, one in Mineral Technology and the other in Mining Engineering, leading to the award of a Graduate Diploma (Grad. Dip.).

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 processes for the physical and physico-chemical separation and concentration of minerals or coal for subsequent use.

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.	Pvte. Study	Lec./Lab.	Pvte. Study
7.391G	Mineral Processing	0	0	5	6
7.551	Mining and Mineral Process Engineering, Parts I and II	4	2	0	0
25.201	Mineralogy, Parts I and II	2	2	2	2
		6	4	7	8
YEAR 2—PART-TIME					
7.392G	Mineral Processing Technology, Parts I and II	3	6	3	6
7.332G	Mineral Engineering—Laboratory	3	4	3	4
		6	10	6	10

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.	Pvte. Study	Lec./Lab.	Pvte. Study
7.121	Mine Surveying and Control Engineering	2	1½	0	0
7.191G	Mining Engineering	0	0	6	6
7.551	Mining and Mineral Process Engineering, Parts I and II	4	2	0	0
		6	3½	6	6
YEAR 2—PART-TIME					
7.192G	Mining Engineering Technology, Parts I and II	4	6	4	6
7.193G	Mining Engineering Laboratory	3	3	3	3
		7	9	7	9

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 which is of such overall importance to Australia.

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

The normal requirement for admission to the course is a degree in Agriculture, Veterinary Science or Science, in an appropriate field. In addition, students may be required to take a qualifying examination in the basic disciplines of the Wool Technology 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:

FULL-TIME COURSE

		Hours per week for 2 Sessions		
		Lec.	Lab.	Pvte. Study
9.105G	Advanced Livestock Production	4	0	6
9.503G	Wool Study	2	4	4
	Plus one of the following optional subjects:			
9.711G	Advanced Wool Technology	2	2	6
9.902G	Techniques of Laboratory and Field Investigation	2	2	6
	Approved undergraduate subjects	4	4	8

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 (Grad.Dip.).

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
1.011 Higher Physics I } For students taking 2 full years of Physics

TEXTBOOKS

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

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.* Univ. of N.S.W. Press.

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.

Russell, G. J., and Mann, K. *Alternating Current Circuit Theory.* Univ. of N.S.W. Press.

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

1.113 Physics III

TEXTBOOKS

Unit A

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

Unit B

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

Unit C

Blakemore, J. S. *Solid State Physics.* W. B. Saunders, 1969.
Jackson, E. A. *Equilibrium Statistical Mechanics.* Prentice-Hall, 1968.

Unit D

TEXTBOOK

Brandt, J. C. *The Sun and Stars.* McGraw-Hill.

Higher Physics 1.123

TEXTBOOKS

Unit A

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

Unit B

Corson, D., and Lorrain, P. *Introduction to Electromagnetic Fields and Waves.* Freeman.
Reif, F. *Fundamentals of Statistical and Thermal Physics.* McGraw-Hill.

Unit C

Burcham, W. E. *Nuclear Physics and Introduction.* Longmans, 1963.
Kittel, C. *Introduction to Solid State Physics.* 3rd ed. Wiley, 1967.

Unit D

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

Van der Ziel, A. *Introduction to Electronic Circuits.* Allyn & Bacon, 1969.

1.143C Magnetism

TEXTBOOK

None prescribed.

1.212 Physics IIT

Unit B (Electronics)

TEXTBOOK

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

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. *Chemical Data Book*. 2nd ed. Wiley, 1966.

Barrow, G. M., Kenney, M. E., Lassila, J. D., Litle, R. L., and Thompson, W. E. *Understanding Chemistry*. Benjamin, N.Y., 1969.

Chemistry I Laboratory Manual. Univ. of N.S.W., 1971.

Hart, H. & Schuetz, R. D. *Organic Chemistry*. Feffer and Simons, 1967.

O'Malley, R. F. *Problems in Chemistry*. McGraw-Hill, 1968.

Turk, A., Meislich, H., Brescia, F., and Arents, J. *Introduction to Chemistry*. Academic Press, 1968.

2.002A Chemistry II (Physical Chemistry)

TEXTBOOKS

Aylward, G. H., and Findlay, T. J. V. *Chemical Data Book*. 2nd ed. Wiley, 1966.

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

Daniels, F. et al. *Experimental Physical Chemistry*. 6th or 7th ed. McGraw-Hill, 1962 or 1970.

Shaw, D. J. *Introduction to Colloid and Surface Chemistry*. Butterworth, 1966.

2.002B Chemistry II (Organic Chemistry)

TEXTBOOKS

1. Roberts, J. D., and Caserio, M. C. *Modern Organic Chemistry*. Benjamin, 1967.

Students intending to study Organic Chemistry in later years may consider either of the following which are suitable alternatives and are the recommended textbooks for third year:

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

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

2. 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/Analytical Chemistry)

TEXTBOOKS

Flaschka, H. H., Barnard, A. J., and Sturrock, P. E. *Quantitative Analytical Chemistry*. Vols. I and II. Barnes and Noble, 1969.

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 & Co., Lexington, 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*. 6th or 7th ed. McGraw-Hill, 1962 or 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

1. 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.
2. 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 Applied Organic Chemistry (Food)

No prescribed textbook.

2.261 Applied Organic Chemistry (Food)

No prescribed textbook.

2.311 Physical Chemistry I

TEXTBOOKS

Aylward, G. H., and Findlay, T. J. V. *Chemical Data Book.* 2nd ed. Wiley, 1966.

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

Daniels, F. et al. *Experimental Physical Chemistry.* 6th or 7th ed. McGraw-Hill, 1962 or 1970.

Shaw, D. J. *Introduction to Colloid and Surface Chemistry.* Butterworth, 1966.

2.322 Physical Chemistry II

TEXTBOOKS

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

Coulson, C. A. *Valence.* 2nd ed. O.U.P., 1961.

Daniels, F. et al. *Experimental Physical Chemistry.* 6th or 7th ed. McGraw-Hill, 1962 or 1970.

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

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

Reed, R. I. *Ion Production by Electron Impact.* Academic, 1962.

2.331 Applied Physical Chemistry

No prescribed textbook.

2.411 Inorganic Chemistry I

TEXTBOOK

Cotton, F. A., and Wilkinson, G. *Advanced Inorganic Chemistry.* 2nd ed. Wiley, 1966.

2.511 Analytical Chemistry I

TEXTBOOKS

Brown, C. H., and Sallee, E. M. *Quantitative Chemistry.* Prentice-Hall, 1963.

Lingane, J. J. *Analytical Chemistry of Metallic Elements.* Reinhold, 1966.

2.611 Organic Chemistry I

TEXTBOOKS

1. Roberts, J. D., and Caserio, M. C. *Modern Organic Chemistry.* Benjamin, 1967.

Students intending to study Organic Chemistry in later years may consider either of the following which are suitable alternatives and are the recommended textbooks for third year:

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

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

2. 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

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, Reynold's 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.

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.

REFERENCE BOOKS
Bennett, C. O., and Myers, J. E. *Momentum, Heat and Mass Transfer,* McGraw-Hill.
Carslew, H. S., and Jaegar, J. C. *Conduction of Heat in Solids.* Oxford, London, 1947.
Dusinberre, G. M. *Numerical Analysis of Heat Flow.* McGraw-Hill, New York, 1949.
Foust, A. S. et al. *Principles of Unit Operations.* Wiley.
Kern, D. Q. *Process Heat Transfer.* McGraw-Hill, New York, 1950.
Larian, M. G. *Fundamentals of Chemical Engineering Operations.* Constable.
Levenspeil, O. *Chemical Reaction Engineering.* Wiley, New York, 1962.
McAdams, W. H. *Heat Transmission.* 3rd ed. McGraw-Hill, New York, 1954.
Purchas, D. B. *Industrial Filtration of Liquids.* Leonard Hill, London, 1967.
Scheidegger, A. E. *The Physics of Flow Through Porous Media.* Univ. of Toronto Press, Toronto, 1957.
Sparrow, E. M., and Cess, R. D. *Radiant Heat Transfer.* Brooks/Cole, Belmont, Calif., 1969.

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
Levenspiel, O. *Chemical Reaction Engineering.* 2nd ed. Wiley.
Smith, J. M., and Van Ness, M. C. *Introduction to Chemical Engineering Thermodynamics.* McGraw-Hill.

REFERENCE BOOKS
Astarita, G. *Mass Transfer with Chemical Reaction.* Elsevier, 1967.
Hougen, O., Watson, K., and Ragatz, R. *Chemical Process Principles.* Part II. 2nd ed. Wiley.
Pourbaix, M. J. N. *Atlas of Electrochemical Equilibria in Aqueous Solutions.* Pergamon.
Van Zeggereu, F., and Storey, S. H. *The Computation of Chemical Equilibria.* Cambridge University Press.
King, M. B. *Phase Equilibria in Mixtures.* Pergamon, 1969.
Dancwerts, P. V. *Gas-Liquid Reactions.* McGraw-Hill, New York, 1970.

3.123 Chemical Engineering Design I

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.

Project Assignments—During the course, two projects are assigned, an "Industrial Process Report" and a "Design 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. The Design Report is 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.

TEXTBOOKS

Perry, J. H. ed. *Chemical Engineering Handbook*. 4th ed. McGraw-Hill.

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.
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.
Coughanowr, D. R., and Koppel, L. B. *Process Systems Analysis and Control.* McGraw-Hill, 1965.

3.124 Combined Chemical Engineering Design and Practice Examination

Taken by B.Sc. (Tech.) students in Stage VI. Test of knowledge of principles and design as applied to a possible industrial situation.

3.131 Chemical Engineering Principles III

Separation processes for multi-component systems. Optimization methods. Use of computers to solve mass transfer problems by analytical stage-wise calculations. Heat, mass and momentum calculations using transport phenomena approach.

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.
Conte, S. D. *Elementary Numerical Analysis.* McGraw-Hill, 1965.
Coulson, J. M., and Richardson, J. F. *Chemical Engineering.* Vols. 1 and 2. Pergamon, 1968.
Treybal, R. E. *Mass Transfer Operations.* 2nd ed. McGraw-Hill, 1961.
Valentin, F. H. H. *Absorption in Gas-Liquid Dispersion.* Spon.

REFERENCE BOOKS

Himmelblau, D. M. *Process Analysis by Statistical Methods.* Wiley, 1970.
Wilde, D. J. & Beighler, 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

Distefano, J. J. et al. *Feedback and Control Systems.* Schaum, 1967.

REFERENCE BOOKS

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

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.

TEXTBOOK

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

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.

Levenspeil, O. *Chemical Reaction Engineering.* Wiley, 1963.

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 Chemical Engineering Principles IVA

Multi-component phase equilibrium relationships, azeotropy, specialized continuous and batch separation processes, control of distillation columns, non-Newtonian technology, multi-stage reactor systems. Numerical methods and the application of analogue and digital computers to the solution of engineering problems. Computer aided design. Associated assignments to be carried out concurrently.

TEXTBOOKS

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

Coulson, J. M., and Richardson, J. F. *Chemical Engineering.* Vols. 1 & 2. Pergamon, 1968.

Valentin, F. H. H. *Absorption in Gas-Liquid Dispersion.* Spon.

REFERENCE BOOKS

Denbigh, K. *Chemical Reactor Theory.* C.U.P., London, 1965.

Scatterfield, C. N. *Mass Transfer in Heterogeneous Catalysis.* M.I.T. Press, Cambridge, 1969.

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

3.135 Chemical Engineering IVB

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 Chemical Engineering Principles IVA.

3.140 Chemical Engineering Projects

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

3.150 Chemical Engineering Projects

An experimental investigation of some aspects of chemical engineering.

CHEMICAL ENGINEERING GRADUATE SUBJECTS

3.163G Ground and Surface Water Treatment and Re-use

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 Plant and Process Design

Engineering design and operating characteristics of processes normally used, e.g., continuous and batch reactors, chemical and biological; mixed feeds and organisms; sterilization; special separation methods.

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.

3.166G Trade Waste Disposal

Origin and nature of gaseous pollutants; fume, odour, dusts, detection and control. Case histories of special chemical process problems. Origin and nature of solid wastes; handling and disposal. Incineration.

3.170G Process Principles

Materials 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 Seminar

Joint University/industry colloquia on theory and practice of corrosion technology.

Students will present material arising from literature and/or laboratory assignments and industrialists will be invited to contribute papers and/or participate in the colloquia.

3.176G Corrosion Literature Review

Students will be expected to consult and read the wide literature on corrosion and to produce a comprehensive and detailed report on a selected topic, e.g. aspects of corrosion in the acid industry; marine corrosion; corrosion problems in the food industry; underground corrosion of pipelines.

3.177G Testing Laboratory

Candidates will undertake a project involving the design/evaluation of corrosion testing equipment/techniques. A comprehensive report will be submitted.

3.181G Advanced Process Dynamics

Distributed-Parameter Linear Systems: Selected distributed-parameter and mathematically similar systems. Methods of analysis and features of their response. Feedback systems containing deadtime. Heat exchangers. Distillation columns. *Nonlinear Systems:* Selected nonlinear systems, e.g. chemical reactors, flow systems, radiant heat transfer. Numerical solutions. Phase plane analysis. Limit cycles.

3.182G Process Optimization

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

3.211 Food Technology IA

The technology of fruits and vegetables—Horticultural factors, maturity assessment, harvesting, precooling, packaging, transportation. Plant respiration, principles of gas and cold storage, induced physiological defects. Microbiology of plant foods. Principles of canning and freezing technology. Thermal processing and process evaluation. Dehydration and sun drying. Microbiology of canned, frozen and dehydrated plant foods, diagnosis of spoilage. Preservation by use of salt, sugar and chemical preservatives. Students will also take the subject 43.111 Botany from the School of Biological Sciences which covers the essential structure and function of higher plants.

TEXTBOOKS

Duckworth, R. B. *Fruit and Vegetables.* Pergamon.
Earle, R. L. *Unit Operations in Food Processing.* Pergamon.

3.212 Food Technology IB

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

Earle, R. L. *Unit Operations in Food Processing.* Pergamon.
Kent, N. L. *Technology of Cereals.* Pergamon.
Lawrie, R. A. *Meat Science.* Pergamon.

3.221 Food Technology II

The characteristics of food quality. Colour, its subjective and objective assessment, colour instrumentation. Flavour, physiology or flavour perception, taste evaluation, separation and identification of flavour constituents. Texture and consistency. Nutrition, the evaluation of diets. Food irradiation. Students will also take 45.211 Entomology offered by the School of Biological Sciences.

3.222 Food Technology Project

The student will undertake an individual project involving a literature survey, an experimental investigation, and the final preparation of a detailed report on a selected topic in food science or technology.

3.231 Chemical Engineering

Fundamentals and application of the following topics: fluid flow, heat transfer, evaporation and drying, refrigeration, instrumentation and psychrometry, and materials of construction.

TEXTBOOKS

Earle, R. *Unit Processes in Food Engineering.* Pergamon.
Foust, A., et al. *Principles of Unit Operations.* Wiley.

3.233 Food Technology

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.

This subject will be available as an elective in 1972.

3.240 Food Technology Project

Project in Food Technology for students in Chemical Engineering.

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 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 BOOK
Ministry of Power (U.K.). *The Efficient Use of Fuel.* H.M.S.O. Inst. of Petroleum. *Modern Petroleum Technology.*

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 IIIA

Part I: Instrumentation and Automatic Control: Principles of design and operation of instruments applicable to fuel-using plant. Temperature, pressure and flow measurements. Electric and pneumatic transmission systems. Electronic telemetering. Fundamentals of automatic control: proportional, integral, derivative and three-term controls. Applications of control systems to boilers and other fuel-using plant.

Part II: Fuel Plant Technology and Design: Refractories and insulating materials and their application in the construction of fuel-using plant. Properties of significance to fuel economy. Behaviour of refractories in industrial retorts, ovens, furnaces and kilns.

Fuel-using plant: boilers, furnaces, ovens, kilns and cupolas: principal types and methods of application of different fuels. Fundamental features of plant design, construction and operation; heat release and distribution; heat transmission and distribution to furnace charge and structure; sources of heat loss, flow patterns and draughting in furnace systems.

Heat recovery, recuperation and regeneration; relationship between load and efficiency. Auxiliary plant, process steam and water; feed water treatment and condensate recovery.

Appropriate laboratory experiments, and design assignments.

TEXTBOOKS
Kern, D. Q. *Process Heat Transfer.* McGraw-Hill, 1950.
McAdams, W. H. *Heat Transmission.* McGraw-Hill.

REFERENCE BOOKS
Ethesington, H. G. *Modern Furnace Technology.* 3rd ed. Griffin.
Trinks, W. *Industrial Furnaces.* Vols. 1 and 2. Wiley.
Norton, F. H. *Refractories.*
Schack, A. *Industrial Heat Transfer.* Chapman & Hall.

3.332 Fuel Engineering IIIB

Part I: Thermal Engineering: Heat transfer related to flames, furnace enclosures and complex shapes; calculations of flame temperature. Analytical, numerical and analogue methods of computation. Dimensional analysis and models in the study of aerodynamics and flame behaviour in furnaces and related plant. Process control dynamics with particular reference to instrumentation and control of fuel plant; analysis of control system responses including the use of analogue computers. Thermodynamic cycles in power generation; recent research and development in the field of conversion of heat to electricity. Brief review of rocket fuels, explosives, and their uses.

Part II: Thermal Processing: A more detailed treatment of some of the topics from 3.311 Fuel Engineering I, as follows:—

Coal carbonization science and its application to the production of metallurgical coke. Recovery and purification of liquid and gaseous products.

Petroleum processing; the properties of petroleum fractions and the theoretical basis of some of the unit operations involved. The production of liquid and gaseous fuels from synthesis gas; coal and oil hydrogenation.

Thermodynamics of gasification processes and the calculation of yields. Particle mechanics, and applications in beneficiation of fuels, collection and sampling of dusts and combustion effluents. Examination of dusts; size analysis and distribution. Fluidization and fluidized bed processes used in the fuel industries.

Atmospheric pollution control and techniques.

Part III: Fuel Science II: Constitution of mineral oils. Molecular type analysis. Relation of hydrogen content to molecular structure. Structural group analysis. Classification of mineral oils.

Coal petrology: macerals, minerals and microlithotypes. Influence of the petrographic composition on the technical uses of coal.

Coal constitution: Development of theories on the ultrafine physical and chemical structure of coal by the application of modern techniques. Statistical constitution analysis. Possible industrial applications. The action of heat on coal: pyrolysis of the various petrographic constituents. The mechanism of coking and of tar formation.

TEXTBOOKS
Field, M. A., et al. *Combustion of Pulverised Coal.* B.C.U.R.A.
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.

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

A non-examinable subject designed to meet the needs of individual students in the graduate diploma course, which stresses 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 Post-Graduate 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, Part II, Fuel Plant Technology and Design.

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 and its study by various techniques including dimensional analysis and models. Process control dynamics and control system response analysis by analytical and analogue computation methods. Developments in power generation; thermodynamics of combined cycles, high temperature direct conversion, propulsion systems, etc.

Coal carbonization and by-product recovery. Petroleum processing and the production of liquid and gaseous fuels from synthesis gas and by coal and oil hydrogenation. Thermodynamic calculations of gasification yields. Particle mechanics and application to fuel beneficiation, sampling and size analysis of dusts, and fluidization. Industrial applications of fluidized bed processes.

Appropriate laboratory experiments.

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.

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 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*

(i) Engineering Technology

(ii) Computers: Introduction and Concepts

Textbooks will be prescribed.

(iii) Introduction to Engineering Design Option

Harrisberger, L. *Engineeringsmanship.* Wadsworth.

or

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

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

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, 1966. *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.* 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

7.110 and 7.110/1 Mineral Resources

Part 1. Principles of mining, exploration, mine development, mine production, extension of operations. Salient data on the mineral industry, fuels, metals, industrial minerals. 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.
Fullard, H. *Atlas of the World.* E.U.P.
Com. of Aust. *The Australian Mineral Industry Annual Review.* Bur. of Min. Res.

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. Support of development excavations, temporary, stabilising and long term. Mining applied to civil engineering projects.

Part 2. Advanced mining systems. Analysis of mining methods and graphical models of mining methods. Surface methods: quarries, open cuts, dredging. Coal; horizon, room and pillar, long wall. Metals; open stoping, shrinkage, cut and fill square set, caving. Non-entry; leaching in situ, salt, sulphur, gas, petroleum, underground gasification. Parameters for efficiency in mining techniques. Grade control and blending. Mine filling, pillars.

TEXTBOOKS

Calhoun, J. C. *Fundamentals of Reservoir Engineering.* Univ. Oklahoma Press, 1957.
Fleider, 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. State of stress in earth's crust, subsidence, strata control, rock bursts, physical properties of rocks.

Part 2. Mining tectonics and rock mechanics. Power supply and transmission. Mine drainage, pumps, pump stations, flooding and dewatering, removal of fluid from porous strata. 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.(Tech.) course. Based on topics selected from the syllabus of 7.112.

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.

7.113/1 Mineral Industry Elective Project

For students in the B.Sc. (Tech.) Course. Based on the syllabus of 7.113.

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.
Leonard, J. W. & Mitchell, D. R. *Coal Preparation.* A.I.M.E.
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.
Taggart, A. F. *Handbook of Mineral Pressing.* Wiley.

7.115 Mining Engineering III

Feasibility planning and mine design. Explosives engineering. Advanced rock mechanics. Petroleum engineering. Computer applications to mining transport.

TEXTBOOK

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

7.116 Mining Engineering IV

Feasibility planning and mine design. Advanced mine ventilation, network analysis, refrigeration. Automation and mine control systems. Offshore mining. Tectonics of non-entry methods of mining, including use of nuclear blasting. Computer applications to mining methods.

TEXTBOOKS

Metal and Mineral Resources of the Sea. Pergamon.
Jaeger, J. C. & Cook, N. G. W. *Fundamentals of Rock Mechanics.* Methuen, 1969.

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 and programming of mining methods or techniques. Method of production control and grade control. Mathematical models of mining methods.

7.121/1 Mine Surveying

For students in the B.Sc.(Tech.) 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. Resource allocation, finance, shares, transport, ports, housing, labour requirements.

TEXTBOOK

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

7.133 Mineral Economics

Economics of the mineral industry. International statistics. Impurities, percentage recoveries, markets, grade control. Extractive processes and their influence on product control and allied minerals required.

TEXTBOOK

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

7.311 Mineral Processing I, Parts 1 and 2

Applied mineralogy, assessment of physical and chemical properties, liberation process design. 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. Fluid mechanics of mineral pulps, free, hindered and zone settling, thickening, classification, dewatering.

7.311/1 Mineral Processing I

For students in the B.Sc.(Tech.) course; 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

Chemical processing and extraction. Bacterial leaching. In situ recovery processes. Integration of mineral processing techniques with metallurgical operations. Product control.

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

7.316 Mineral Processing III

Surface chemistry of mineral particles, flocculation, froth flotation. Process engineering, flow sheets and plant design. Materials handling, mill control, automation.

TEXTBOOKS
Fuerstenau, D. W. ed. *50th Anniversary of Froth Flotation*. A.I.M.E.
or
Gaudin, A. M. *Flotation*. McGraw-Hill.
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, Parts 1 and 2

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, principles, types of mineral deposits principles of mine and quarry development. Classification of mining extraction methods, applications to coal, non-metallic and metalliferous deposits. Petroleum production engineering. 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
Lewis, R. S. & Clark, G. B. *Elements of Mining*. Wiley.
Gaudin, A. M. *Principles of Mineral Dressing*. McGraw-Hill.

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. Particle size distribution and analysis. Mathematical analysis of the technology of comminution. Fluid mechanics of particle and fluid systems, thickening classification. Material handling.

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

Applied mineralogy, gravity separation processes, electrostatic and magnetic separation. Surface chemistry of mineral particles, flotation, flocculation. Chemical processing and extraction. 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.
Leonard, J. W. & Mitchell, D. R. *Coal Preparation.* A.I.M.E.

7.332G Mineral Engineering Laboratory

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

8.243 Soil Mechanics

TEXTBOOK

Terzaghi, K., and Peck, R. B. *Soil Mechanics in Engineering Practice.* 2nd ed. Wiley.

8.251 Properties of Materials

TEXTBOOK

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

8.253 Civil Engineering Materials

TEXTBOOK

Part 11

Wu, T. H. *Soil Mechanics.* Allyn & Bacon, 1966. *or*

Terzaghi, K., and Peck, R. B. *Soil Mechanics in Engineering Practice.* 2nd ed. Wiley, 1967.

8.511 Hydraulics

TEXTBOOKS

Giles, R. B. ed. *Fluid Mechanics and Hydraulics.* Schaum Pub. Co., N.Y.

Vennard, J. K. *Elementary Fluid Mechanics.* Wiley 4th ed. 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 II

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 II

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. E. *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.
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. *Economics: An Introductory Analysis.* 7th ed. McGraw-Hill, N.Y. 1967.

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

Critical appraisal of farm management planning techniques discussed in 9.313 Farm Management I.

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

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 II

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 II

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 II

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, inter-relationships, genetics and sheep 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. *Algebra,* U.N.S.W.
Purcell, E. J. *Calculus with Analytic Geometry.* Appleton-Century-Crofts.

10.011 Higher Mathematics I

TEXTBOOKS

Blatt, J. M. *Introduction to Fortran IV Programming.* Prentice-Hall.
Fagg, S. V. *Differential Equations.* E.U.P.
Spivak, M. *Calculus.* Benjamin.

10.021 Terminating Mathematics I

TEXTBOOKS

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

Purcell, E. J. *Calculus with Analytic Geometry.* Appleton-Century-Crofts.

10.022 Mathematics

10.031 Mathematics

TEXTBOOK

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

10.032 Mathematics

TEXTBOOK

Wylie, C. R. *Advanced Engineering Mathematics.* 3rd ed. McGraw-Hill.

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

Miller, I., and Freund, J. E. *Probability and Statistics for Engineers.* Prentice-Hall.

10.351S Statistics

An introduction to probability theory, with finite, discrete and continuous sample spaces. Random variables: the standard elementary distributions including the binomial. Poisson and normal distributions. Sampling distributions, with emphasis on those derived from the normal distribution: t, x^2 and F. Estimation of parameters: the methods of moments and maximum likelihood, and confidence interval estimation. The standard tests of statistical hypotheses, and, where appropriate, the powers of such tests. An introduction to regression and the bivariate normal distribution.

SCHOOL OF ARCHITECTURE AND BUILDING

11.471 Planning Law and Administration

TEXTBOOK

N.S.W.—Parliament—Statutes. *Local Government Act 1919.* Govt. Printer. Sydney, 1966.

SCHOOL OF APPLIED PSYCHOLOGY

12.001 Psychology

TEXTBOOKS

Part A—Theory

Birney, R. C., and Tecvan, R. C. eds. *Measuring Human Motivation.* Van Nostrand, 1962.

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

Hilgard, E. R., and Atkinson, R. C. *Introduction to Psychology.* 4th ed. Harcourt, N.Y., 1967.

Savage, R. D. *Psychometric Assessment of the Individual Child.* Penguin, 1968.

Part B—Practical

Llewellyn, K. *Statistics for Psychology I.* U.N.S.W., 1968.

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 and practice of winding, warping, sizing and healding. Primary motions of weaving related to simple looms, shedding by tappet and over-motions. Secondary motions, warp release, warp stop motions. Loom timing and tuning. Cloth defects.

TEXTBOOK

Booth, J. E. *Principles of Textile Testing.* 3rd ed. National Trade Press, 1961.

13.112 Textile Technology II

Fabric Manufacture: Principles of knitting. Historical development of knitting techniques. The basic knitting stitches and their application in fabric production. Standard mechanisms of knitting machines. Dobby, shutterless and circular looms. Factory organization and layout. Quality control and costing in weaving. Weaving and knitting developments and research. A study of the general principles of the design of single cloth structures. Drafting simple and complex. Colour theories and application of colour. *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. *Textile Testing:* Physical testing of fabrics. Evaluation of the serviceability of textile fabrics. Qualitative and quantitative assessment of damage in textile materials.

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.

TEXTBOOK
Peters, R. H. *Textile Chemistry*. Vol. 2. Elsevier, 1967.

13.113 Textile Technology III

Yarn Manufacture: Recent research and development in yarn manufacture. *Textile Testing:* Functions of quality control. The organization and integration of a quality control department in a textile factory. Fault investigation. Recent developments and trends in industrial textile testing methods. *Dyeing and Finishing:* Physical-chemical concepts of dyeing. Methods of control of dyeing. Colour changes subsequent to dyeing. The production of specified dimensions in textile fabrics. The development of specific properties: mechanical, surface finishes, protective finishes. *Fabric Manufacture:* Compound cloth structures. Pile fabrics, tapestries, gauzes and carpets. Cloth setting theories. Felts and non-woven fabrics. Review of standard fabrics in natural and man-made fibres. Analysis of finished fabrics. Fabric development and research. Advanced knitting techniques. Design in fabrics by needle selection. Knitted fabric geometry; quality control in fabric production. Basic garment assembly.

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.

13.311 Textile Engineering I

Textile mill location, design and layout. Application of electricity and mill illumination. Mechanical power transmission. Properties of steam and heat transfer. Introduction to methods engineering.

13.312 Textile Engineering II

Air conditioning, industrial instrumentation, process steam, lubrication, introduction to automatic control.

SCHOOL OF ACCOUNTANCY

14.111 Accounting I

TEXTBOOKS

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

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.

14.321 Business Finance

TEXTBOOKS

Van Horne, J. C. *Financial Management and Policy.* Prentice-Hall, 1969.

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

Abraham, W. *National Income and Economic Accounting.* Prentice-Hall, 1969.

Australian National Accounts. 1971.

Lipsey, R. G. *An Introduction to Positive Economics.* 2nd ed. Weidenfeld & Nicolson, 1966.

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.* Weidenfeld & Nicolson, 1967.

15.102 Economics II

TEXTBOOKS

Chamberlain, N. ed. *Contemporary Economic Issues.* Irwin, 1970.
Lipsey, R. G. *An Introduction to Positive Economics.* 2nd ed. Weidenfeld & Nicolson, 1966.
Mansfield, E. *Microeconomics.* Norton, 1970.
Nevile, J. W. *Fiscal Policy in Australia.* Cheshire, 1970.
Rowan, D. C. *Output Inflation and Growth.* Macmillan, 1968.
Runcie, N. *Economics of Instalment Credit.* London Univ. Press, 1969.
Spencer, M. H. *Managerial Economics.* 3rd ed. Irwin, 1968.

15.103 Economics III

TEXTBOOKS

Matthews, R. C. O. *The Trade Cycle.* Nisbett & C.U.P., 1959.
Report of the Committee of Economic Enquiry. (Vernon Report) Vols. I and II. Commonwealth of Australia, Canberra, 1965.
Runcie, N. *Economics of Instalment Credit.* London Univ., 1969.
Nevile, J. W. *Fiscal Policy in Australia.* Cheshire, 1970.

15.243 Economic Development

TEXTBOOKS

Higgins, B. *Economic Development.* 3rd ed. Constable. London, 1968.
Lewis, W. A. *Development Planning.* Harper & Row, N.Y., 1966.

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.

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.

18.551 Operations Research

TEXTBOOK

Houlden, B. T. ed. *Some Techniques of Operational Research.* E.U.P., 1962.

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 diigtal 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 thermodynamics; 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.

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.*

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.
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.
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.

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 (1¼" 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 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. Thermomechanical 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 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

Bryan, J. H., McElroy, C. T., and Rose, G. *Explanatory Notes to Accompany the Sydney 4-mile Geological Map (with map).* 3rd ed. Bureau of Mineral Resources, Canberra, 1966.

Hurlbut, C. S., Jr. *Dana's Minerals and How to Study Them.* 3rd Science ed., Wiley, 1963.

Longwell, C. R., and Flint, R. F. *Introduction to Physical Geology.* Wiley.

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.

25.002 Geology II

Crystallography and Mineralogy—Morphological and physical crystallography. Stereographic projections and their use in crystallography. Introduction to the crystalline state and X-ray crystallography. Description of ore and rock-forming minerals and their physical and chemical properties. Introduction to crystal chemistry. *Laboratory*—recognition of crystal forms by use of stereographic projections and description of ores and minerals in hand specimen.

Petrology—Introduction to optics and the petrological microscope. Optical properties of the rock forming minerals. Occurrence, genesis and diversification of the igneous rocks. *Laboratory*—Microscopic and megascopic examination of various rock types.

Palaeontology—Systematic classification of the Invertebrate phyla, with detailed morphological study of their important subdivisions. Introduction to the principles of palaeontology and its stratigraphical applications. Introduction to palaeobotany. *Practical Work:* Examination and diagnostic description of representative fossils from the various phyla and study of their stratigraphical distribution.

Stratigraphy—The stratigraphic column. Principles of stratigraphy. Sedimentary processes and products. Classification of sedimentary rocks. Environments of deposition. Primary sedimentary structures. The facies concept. The stratigraphy of selected geological provinces in eastern Australia.

Structural Geology—The interdependence of geotectonics and structural geology. Force, stress and strain within the geological environment; the relationship between stress and strain ellipsoids. Primary structures and introduction to the main categories of secondary structure encountered in non-metamorphic and metamorphic terrains. *Field work*—Approximately twelve days will be spent on field tutorials throughout the year.

TEXTBOOKS

Petrology I

Kerr, P. F. *Optical Mineralogy*. McGraw-Hill, 1959.

Williams, H., Turner, F. J., and Gilbert, C. M. *Petrography*. Freeman, 1954.

Palaeontology I

Easton, W. H. *Invertebrate Paleontology*. Harper, 1960. *or*

Moore, R. C., Lalicker, C. G., and Fischer, A. G. *Invertebrate Fossils*. McGraw-Hill, 1952.

Stratigraphy I

Dunbar, C. O., and Rodgers, J. *Principles of Stratigraphy*. Wiley, 1957.

Mineralogy

Bloss, F. D. *An Introduction to the Methods of Optical Crystallography*. Holt, Rinehart & Winston, 1967.

Deer, W. A., Howie, R. A., and Zussman, J. *An Introduction to the Rock-forming Minerals*. Longmans, Green, 1966.

Heinrich, E. W. *Miscroscopic Identification of Minerals*. McGraw-Hill, 1965.

or

Kerr, P. F. *Optical Mineralogy*. 3rd ed. McGraw-Hill, 1959.

Hurlbut, C. S. ed. *Dana's Manual of Mineralogy*. Wiley.

Bason, B., and Berry, L. G. *Elements of Mineralogy*. 2nd ed. Freeman, 1968.

Phillips, F. C. *An Introduction to Crystallography*. Longmans.

Wahlstrom, E. E. *Optical Crystallography*. 4th ed. Wiley, 1969.

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.

25.101S and 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, twinning, 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)

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.
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.
Thomas, W. L. ed. *Man's Role in Changing the Face of the Earth*. Chicago U.P.
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*. Patterns and structures of systems of agriculture, manufacturing, and tertiary production. Underdeveloped and advanced societies. Origins and functions of the settlement network of central places and connecting routes in the fields of urban and transportation geography. Laboratory classes include case studies.

TEXTBOOKS

McCarty, H. H., & Lindberg, J. B. *A Preface to Economic Geography*. Prentice-Hall.

REFERENCE BOOKS

Breese, G. *Urbanisation in Newly Developing Countries.* Prentice-Hall.
Chisholm, M. *Rural Settlement and Land Use.* Hutchinson.
Dicken, S. N., & Pitts, F. R. *Introduction to Human Geography.* Gunn-Blaisdell.
Estall, R. C., & Buchanan, R. O. *Industrial Activity and Economic Geography.* Hutchinson.
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.

Part II (Session 2). *Geographic Models.* Aims and methods of enquiry as a basis for discerning pattern and order in the economic landscape. Emphasis on locational models which attempt to explain the pattern and structure of urban settlement and transportation routes. Laboratory classes include applications of the models in case studies.

TEXTBOOK

Haggett, P. *Locational Analysis in Human Geography.* Arnold.

REFERENCE BOOKS

Berry, B. *Geography of Market Centres and Retail Distribution.* Prentice-Hall.
Chapin, F. S. *Urban Land Use Planning.* Illinois U.P.
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.

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

Chao, L. L. *Statistics, Methods and Analysis.* McGraw-Hill.
Cole, J. P., & King, C. A. *Quantitative Geography.* Wiley.
Croxton, F. E., & Cawder, D. J. *Applied General Statistics.* Pitman.
Dixon, N. J., & Massey, F. J. *Introduction to Statistical Analysis.* McGraw-Hill.
Kalton, G. *Introduction to Statistical Ideas.* Chapman & Hall.
Moroney, M. J. *Facts from Figures.* Pelican.
Reichmann, W. J. *Use and Abuse of Statistics.* Pelican.
Siegel, S. *Nonparametric Statistics for the Behavioural Sciences.* McGraw-Hill.

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.

27.003 Techniques in Physical Geography

Provides training for physical geographers and other environmental scientists in the acquisition and analysis of environmental data, with emphasis on field techniques and data handling, mainly through laboratory and field work.

Practical climatology: macroclimatic and microclimatic elements and their measurement; operation of a climatic station; handling and presentation of climatic data; weather analysis and forecasting.

Geomorphology: identification and analysis of form elements and measurement of processes; sampling and interpretation of superficial deposits; analysis of maps and airphotos; classification and mapping of land types.

Field Ecology: plant identification and community descriptions; measurement of vegetation; site comparison; sampling and handling of plant materials.

Pedology: soil profile description; soil classification and mapping; laboratory analysis of soil constituents; preparation of samples for analysis.

REFERENCE BOOKS

American Scoiety of Photogrammetry. *Manual of Photographic Interpretation.* George Banker.
Beadle, N. C. W., Evans, D. O., & Carolin, R. C. *Handbook of Vascular Plants of the Sydney District and Blue Mountains.* Private.
Bradley, E. F. & Denmead, O. T. eds. *The Collection and Processing of Field Data.* Wiley.
Chang, Jen-Hu. *Climate and Agriculture.* Aldine.
Chow, Ven Te, ed. *Handbook of Applied Hydrology.* McGraw-Hill.
Commonwealth Bureau of Meteorology. *Manual of Meteorology.* Govt. Printer.
Corbett, J. R. *The Living Soil.* Martindale.
Daubenmire, R. F. *Plant Communities.* Harper & Rowe.
Folk, R. L. *Petrology of Sedimentary Rocks.* Hemphills.
Greig-Smith, P. *Quantitative Plant Ecology.* Butterworth.
King, C. A. M. *Techniques in Geomorphology.* Arnold.
Milner, C. & Hughes, R. E. *Methods for the Measurement of the Primary Production of Grassland.* I.B.P. Handbook No. 6. Blackwell.
Newbould, P. J. *Methods for Estimating the Primary Production of Forests.* I.B.P. Handbook No. 2. Blackwell.
Shields, A. J. *Australian Weather. Jacaranda.*
Stewart, G. A. ed. *Land Evaluation.* Macmillan.
U.S. Dept. of Agriculture. *Soil Survey Manual.* U.S. Govt. Printer.

27.013 Geographic Methods

Laboratory classes dealing with methods of geographic research, with emphasis on field problems, research design, data sources, field methods. Collection, classification, tabulation, presentation and analysis of data, including advanced statistical procedures and electronic data processing. Designed to complement all Third-Year Geography subjects.

TEXTBOOKS

Dixon, W. J. & Massey, F. J. *Introduction to Statistical Analysis.* McGraw-Hill. Paperback.
Jackson, J. N. *Surveys for Town and Country Planning.* Hutchinson. Paperback.
Veldman, D. J. *Fortran Programming for Behavioural Sciences.* McGraw-Hill. Paperback.

REFERENCE BOOKS

Cochran, W. G. *Sampling Techniques.* Wiley.
Cole, J. P. & King, C. A. M. *Quantitative Geography.* Wiley.
Kerlinger, R. *Foundations of Social Research.* Holt, Rinehart & Winston.
Siegal, S. *Nonparametric Statistics for the Behavioural Sciences.* McGraw-Hill.
Ya-lun Chou. *Statistical Analysis with Business and Economic Applications.* Holt, Rinehart & Winston.
Yates, F. *Sampling Methods for Censuses and Surveys.* Griffin.
Yeates, M. H. *Introduction to Quantitative Analysis in Economic Geography.* McGraw-Hill.
Yeomans, K. A. *Statistics for the Social Scientist.* Vols. I and II. Penguin.

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.

REFERENCE BOOKS

Baker, H. G. & Stebbins, G. L. eds. *The Genetics of Colonising Species.* Academic.
Barnett, S. A. ed. *A Century of Darwin.* Heinemann.
Chang Jen-Hu. *Climate and Agriculture.* Aldine.
Daubenmire, R. F. *Plants and Environment.* Wiley.
Gressitt, J. L. ed. *Pacific Basin Biogeography.* Bishop Museum Press.
Hastings, J. R. & Turner, R. M. *The Changing Mile.* Arizona U.P.
McArthur, R. L. & Wilson, E. O. *The Theory of Island Biogeography.* Monographs in Population Biology I. Princeton U.P.
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 1972.

27.303 Urban and Transportation Geography

Recent developments in urban geography. Discussion of urban planning principles and the role of the geographer in analysing physical, social and movement-space problems within the city. Transportation geography includes the structure of transportation systems, for example nodal 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

Berry, B. J. & Horton, F. E. *Geographic Perspectives on Urban Systems.* Prentice-Hall.
Bunge, W. *Theoretical Geography.* Lund Studies in Geography.
Chapin, F. S. *Urban Land Use Planning.* Illinois U.P.
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.
Smith, R. H. T., Taaffe, E. & King, L. eds. *Readings in Economic Geography.* Rand McNally.
Taaffe, E. & Gauthier, W. *Geography of Transportation.* Prentice-Hall.
Theodorsen, G. A. *Studies in Human Ecology.* Harper Rowe.

27.304 Advanced Economic Geography

The formulation of economic models within an interregional framework. Includes activity analysis, simple growth models, growth-pole notions, the spatial transmission of economic growth, interregional trade models, and the spatial pattern of short-term economic interaction. Emphasis on North America.

TEXTBOOK

Nourse, H. O. *Regional Economics.* McGraw-Hill.

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.
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. Laboratory classes involve case studies.

TEXTBOOKS

Alonso, W. *Location and Land Use.* Harvard U.P. Paperback.
Beckmann, M. *Location Theory.* Random House.

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, 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.

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. Laboratory classes involve case studies.

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.
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.

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.
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.
Vincent, W. H. ed. *Economics and Management in Agriculture.* Prentice-Hall.
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

Leopold, L. B., Wolman, M. G. & Miller, J. P. *Fluvial Processes in Geomorphology.* Freeman.
Thornbury, W. D. *Principles of Geomorphology.* Wiley. Paperback.

REFERENCE BOOKS

Bird, E. F. C. *Coastal Landforms.* A.N.U. Press.
Chorley, R. J. ed. *Water, Earth and Man.* Methuen.
Chow, Ven Te. *Handbook of Applied Hydrology.* McGraw-Hill.
Davies, J. L. *Landforms in Cold Climates.* A.N.U. Press.
King, C. A. M. *Techniques in Geomorphology.* Arnold.
Miller, V. C. *Photogeology.* McGraw-Hill.

Morisawa, M. *Streams: their Dynamics and Morphology.* McGraw-Hill.
Ollier, C. D. *Volcanoes.* A.N.U. Press.
Ray, R. G. *Photogeologic Procedures in Geologic Interpretation and Mapping.* U.S. Geol. Survey Bulletin 1043-A.

Part II. *Pedology.* Soil properties and constituents. Further study of soil-landscape relationships. Comparative morphology and genesis of zonal and intrazonal soils. Soil fertility, erosion and conservation. Soil stratigraphy and polygenesis. Laboratory study of soils.

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.
Dasman, 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.
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 hillslope, shoreline, fluvial and dune environments; hydrologic significance of landforms; equilibrium states of landforms and soils and the applicability of model studies; field study of soil equilibrium; absolute dating of landforms and soils and determination of rates of denudation and pedogenesis; effects of pre-weathering on soil formation; periodicity and palaeoforms; selected chronologic studies of landforms and soils; regional studies; soil erosion, its causes and its control by mechanical and biological measures in a range of environments including coastal dunes, hillslopes, scalds and inland dunes; history of geomorphology and pedology, the passage of concepts and current problems; soil stratigraphic mapping; sand grains in sediments and soils; mineral indicators of provenance and weathering; thin sections of weathered rocks and soils; identification of *in situ* and extraneous materials; separation of soils and sediments into size and density fractions; correlative sediments and depositional environments; map and airphoto analyses.

A field tutorial of about one week at the end of first term traversing geomorphic and pedologic environments in south-eastern Australia.

* To be introduced in 1972.

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. & Haggett, P. eds. *Models in Geography*. Methuen.

Chow, Ven Te. *Handbook of Applied Hydrology*. McGraw-Hill.

CSIRO. *The Australian Environment*. M.U.P.

Dury, G. H. ed. *Essays in Geomorphology*. Heinemann.

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.

DEPARTMENT OF MARKETING

28.101 Principles of Marketing

TEXTBOOKS

Enis, B. M. G. & Cox, K. A. *Marketing Classics*. Allyn & Bacon, 1969.

Fisk, G. *Marketing Systems*. Harper & Rowe, 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.

SCHOOL OF BIOCHEMISTRY

41.101

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.

SCHOOL OF BIOLOGICAL TECHNOLOGY

42.201G Theoretical Biology

TEXTBOOKS

Loewy, A. G., and Siekevitz, P. *Cell Structure and Function.* 2nd ed. Holt, Rinehart & Winston, 1969.

42.202G Biochemistry and Microbiology

TEXTBOOKS

Casida, L. E., Jnr. *Industrial Microbiology.* Wiley.

Conn, E. E., and Stumpf, P. K. *Outlines of Biochemistry.* 2nd ed. Wiley, 1966.

Mahler, H. R., and Cordes, E. H. *Biological Chemistry.* Harper, 1966.

Rose, A. H. *Chemical Microbiology.* 2nd ed. Butterworth, 1968.

Stanier, R. Y., Doudoroff, M., and Adelberg, E. A. *General Microbiology.* 2nd ed. Macmillan, 1963 (also pub. under *The Microbial World,* Prentice-Hall). *or*

Pelczar, M. J., and Reid, R. R. *Microbiology.* 2nd ed. McGraw-Hill, 1965. International Student Ed. *or*

Frobisher, M. *Fundamentals of Microbiology.* 8th ed. Saunders, 1968.

SCHOOL OF BOTANY

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.

Eames, A. J., and McDaniels, L. H. *Introduction to Plant Anatomy.* 2nd ed. McGraw-Hill, 1947. *or*

Esau, K. *Anatomy of Seed Plants.* Wiley, 1960.

43.101C Plant Physiology

TEXTBOOKS

Leopold, A. C. *Plant Growth and Development.* McGraw-Hill, 1964.

Salisbury, F. B. & Ross, C. *Plant Physiology.* Wadsworth, 1969.

43.102B Plant Taxonomy

TEXTBOOKS

Beadle, N. C. W., Carolin, R. C. & Evans, O. D. *Handbook of the Vascular Plants of the Sydney District and Blue Mountains.* 1962.

Cronquist, A. *The Evolution and Classification of Flowering Plants.* Nelson, 1968.

Sporne, K. R. *The Morphology of the Gymnosperms.* Hutchinson, 1967.

SCHOOL OF MICROBIOLOGY

44.111 Microbiology

TEXTBOOKS

Frobisher, M. *Fundamentals of Microbiology.* 8th ed. Saunders, 1968. *or*

Pelczar, M. J., and Reid, R. R. *Microbiology.* 2nd ed. McGraw-Hill, 1965 (Available in International Student edition) *or*

Stanier, R. Y., Doudoroff, M., and Adelberg, E. A. *General Microbiology.* 2nd ed. Macmillan, 1963. (Also published under the title of *The Microbial World.* Prentice-Hall.

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