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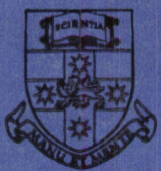
FACULTY OF APPLIED SCIENCE

1969 HANDBOOK



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FOREWORD

The importance of the Applied Sciences in this University's development has always been recognized, and is especially referred to in our Act of Incorporation.

Undergraduate courses in the fields of Applied Geology, Chemical Engineering, Chemical Technology, Metallurgy, Mining Engineering, Textile Technology and Wool Technology 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 1969

Term 1 ..... March 3 to May 17

Term 2 ..... June 2 to August 9

Term 3 ..... September 1 to November 1

JANUARY

Monday 20	Last day for acceptance of applications to enrol by new students and students repeating first year.
Monday 27	Australia Day—Public Holiday.
Tuesday 28	Deferred examinations begin.

FEBRUARY

Saturday 8	Deferred examinations end.
Monday 17	Enrolment week begins for new students and students repeating first year.
Monday 24	Enrolment week begins for students re-enrolling (second and later years).

MARCH

Monday 3	First term begins.
Friday 14	Last day for enrolment of new students (late fee payable).
Friday 28	Last day for enrolment of later year students (late fee payable).

APRIL

Friday 4 to Monday 7	Easter.
Friday 25	Anzac Day—Public Holiday.

MAY

Saturday 17	First term ends.

JUNE

Monday 2	Second term begins.
Monday 16	Queen's Birthday—Public Holiday.
Friday 27	Last day for acceptance of applications for re-admission after exclusion under rules governing re-enrolment.

JULY

Tuesday 1	Foundation Day.
Friday 18	Last day for acceptance of corrected enrolment details forms.

AUGUST

Friday 8	Last day for acceptance of corrected enrolment details forms (late fee payable).
Saturday 9	Second term ends.

SEPTEMBER

Monday 1	Third term begins.
Saturday 20	Annual examinations begin—21- and 24-week courses.

OCTOBER

Saturday 4	Annual examinations end—21- and 24-week courses.
Monday 6	Eight-Hour Day—Public Holiday.

NOVEMBER

Saturday 1	Third term ends.
Saturday 8	Annual examinations begin—30-week courses.
Saturday 29	Annual examinations end.

1970

Term 1	March 2 to May 16
Term 2	June 1 to August 8
Term 3	August 31 to October 31

JANUARY

Tuesday 27 to Saturday, Feb. 7	Deferred examinations.

FEBRUARY

Monday 16	Enrolment week begins for first year students and students repeating first year.
Monday 23	Enrolment week begins for students re-enrolling (second and later years).

MARCH

Monday 2	First term begins.

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CHAIRMAN—Professor F. W. Ayscough

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GENERAL INFORMATION

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, and an evening service is provided during the enrolment period.

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.

Applications for admission to undergraduate courses from students who do not satisfy the requirements for admission (see section on "requirements for admission") from students seeking admission with advanced standing, and from students who have had a record of failure at another university, are referred by the Admissions Office to the Admissions Committee of the Professorial Board.

Students seeking to register as higher degree candidates should discuss their proposals initially with the Head of the School in which they wish to register. An application is then lodged on a standard form and the Admissions Office, after obtaining a recommendation from the Head of the School, refers the application to the appropriate Faculty or Board of Studies Higher Degree Committee.

Details of the procedure to be followed by students seeking entry to first year 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, First Floor, Crystal Palace Arcade, 590 George Street (near Town Hall), Sydney (P.O. Box 7049 G.P.O. Sydney, 2001). 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 order to accept the offer of a place at this University and complete their enrolment at the Enrolment Bureau, Unisearch House, 221 Anzac Parade, Kensington.

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.

It should be noted that compliance with these conditions does not in itself entitle a candidate to enter upon a course. While it is the policy of the University to endeavour to admit all properly qualified applicants who have lodged applications by the appropriate closing date, it may be necessary at times to restrict the entry to one or more faculties because of lack of facilities. Information concerning any such restrictions will be publicized as soon as practicable.*

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.

SECTION A

General Matriculation and Admission Requirements

(for entry to the University in 1969 and until further notice)

1. A candidate may qualify for matriculation by attaining in recognised matriculation subjects at one New South Wales Higher

* **Note:** Facilities available to the University are likely to cause restrictions in 1969 on entry to the Faculties of Architecture, Arts, Commerce and Medicine.

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 recognised 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 recognised 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. Wool Technology course) Biological Sciences Engineering Industrial Arts Course Medicine Military Studies (Engineering course and Applied Science course) Science	(a) Science at Level 2S or higher AND (b) either Mathematics at Level 2F or higher OR Mathematics at Level 2S, provided that the candidates performance in this subject and his general level of attainment are at standards acceptable to the Professorial Board.
Architecture Wool Technology course (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 Military Studies (Arts course) 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.

SUBJECT	SUBJECT PRE-REQUISITES
1.011—Higher Physics I 1.001—Physics I 1.041—Physics IC	As for Faculty of Science
2.011—Higher Chemistry I 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.

ENROLMENT PROCEDURE FOR UNDERGRADUATE COURSES

It is the policy of the University to endeavour to admit all properly qualified applicants who have lodged applications by the appropriate closing date. In 1969 however, facilities available to the University will make it necessary to impose quotas in the faculties of Architecture, Arts, Commerce and Medicine.

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

First Enrolments

Students with Overseas Entry Qualifications

Overseas students and Australian residents relying for admission on overseas qualifications must lodge an application for enrolment prior to 1st October of the year preceding that in which admission is sought.

Local and Interstate Residents

(a) Australian residents including students transferring from one course to another or from another University who have undertaken qualifying examinations in 1968 must lodge an application for enrolment by 20th January, 1969.

(b) Australian residents already qualified for admission and students wishing to resume University studies must apply for enrolment by the 30th November, 1968.

First Year Repeat Students

First year students who fail all subjects at the annual examinations and who are not granted any deferred examinations must apply for re-enrolment to the Admissions Office by 20th January, 1969.

Application forms for enrolment and details of the application procedures may be obtained on application to the Registrar, P.O. Box 1, Kensington, 2033.

Students in the above categories whose applications for enrolment are accepted will be required to complete their enrolment at a specified appointment time before the start of first term. 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.

Later Year Enrolments. All students enrolling other than for the first time and not included above should enrol through the appropriate School and bring with them their notification of examination results for the previous year. This enrolment must be effected before or during the week before the commencement of First Term in accordance with the special arrangements made by the individual schools. However, Medical students in the third and later years of their course, enrol earlier since their academic year commences in advance of the normal commencement date.

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 term (14th March, 1969) 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 term 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 term 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 term where more than 15 hours' per week instruction, etc., is involved.

(i) Full-time Course Fee (more than 15 hours' attendance per week)—$110 per term. In courses in which the Third Term is limited to five weeks of formal studies the fee for this term is $55.

(ii) Part-time Course Fee—over 6 hours' and up to 15 hours' attendance per week—$55 per term.

(iii) Part-time Course Fee—6 hours' or less attendance per week—$28 per term.

(iv) Course Continuation Fee—A fee of $23 per annum (no term 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—$7—payable at the beginning of first year.

Library Fee—annual fee—$12.

Student Activities Fees

University Union—$20—entrance fee.
University Union*—$12—annual subscription.
Sports Association*—$2—annual subscription.
Students' Union*—$5—annual subscription.
Miscellaneous—$10—annual fee.

Graduation or Diploma Fee—$7—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).†

Special Examination Fees

Deferred examination—$5 for each subject.

Examinations conducted under special circumstances—$7 for each subject.

Review of examination result—$7 for each subject.

LATE FEES

First Enrolments

Fees paid at the late enrolment session and before the commencement of term	$6
Fees paid during the first and second weeks of term	$12

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

† Students in the original Applied Biology degree course pay an excursion fee of $1 per subject for botany, zoology and entomology.

Fees paid after the commencement of the third week of term with the express approval of the Registrar and Head of the School concerned $23

Re-Enrolments

First Term

Failure to attend enrolment centre during enrolment week $6

Fees paid after the commencement of the third week of term to 31st March $12

Fees paid after 31st March where accepted with the express approval of the Registrar $23

Second and Third Terms

Fees paid in third and fourth weeks of term $12

Fees paid thereafter $23

Late lodgement of corrected enrolment details forms (late applications will be accepted for three weeks only after the prescribed dates) $5

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 authorisation of course programme. Failure to do so will incur a late fee of $6.

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

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

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 First Term. (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 term (i.e., 14th March, 1969), 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 term, in which case they are required to pay First Term course fees and other fees for the year, within the first two weeks of First Term. Students paying under this arrangement will receive accounts from the University for Second and Third Term fees. These fees must be paid within the first two weeks of each term.

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.

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 or stage, 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 the payment of fees is until 31st March for fees due in First Term and for one month from the date on which a late fee becomes payable in Second and Third Terms.

Where an extension of time is granted to a first year student in First Term, 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 term, 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 Third Term (26th September, 1969).

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 term.

RULES RELATING TO STUDENTS

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.

Course Transfers

Students wishing to transfer from one course to another (including transfer from full-time to part-time study or vice versa) must make application to the Admissions Office. Applications to transfer to courses where quotas apply will not be accepted after January 20th. The Admissions Office will give each applicant an acknowledgement of his application to transfer.

Having made application to the Admissions Office students transferring are required to attend the School Enrolment Centre at the time set down for the year/stage of the new course in which they expect to enrol. They must present the letter granting approval of the transfer to the enrolling officer.

Students who have not received a letter granting approval to the transfer before the date on which they are required to enrol must present their acknowledgement to the enrolling officer who will decide whether to permit them to attend classes provisionally in the new course. Students who are permitted to attend classes provisionally should not pay fees until they have received their letter granting formal approval 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 emphasised that withdrawal from subjects after Term I or failure to sit for the examinations in any subjects for which the student has enrolled

is regarded as failure to pass the subjects unless written approval to withdraw 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 January 20th, 1969. 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

The annual examinations take place in November-December for students in thirty-week courses, and in September for students in twenty-one- and twenty-four-week courses. Timetables showing time and place at which individual examinations will be held are posted on the central notice boards. 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 June. 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 19th July. 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 $5.00 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 $5 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 31st 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, 1962.

(i) As from 1st January, 1962, 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. A student in the medical course shall show cause why he should be allowed to repeat the second year of the course if he has failed more than once to qualify for entry to the third year.

(ii) Notwithstanding the provisions of clause (i), 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

*(iii) 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.

* Rule (iii) in so far as it relates to students in the Faculty of Arts will apply retrospectively as from the 1st January, 1967, and in so far as it relates to students in the Faculty of Medicine, will apply to students enrolling for the first time in 1967 or thereafter.

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.

(iv) 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.

(v) Any student excluded under any of the clauses (i)-(iii) may apply for re-admission after two academic years and such application shall be considered in the light of any evidence submitted by him.

(vi) A student wishing "to show cause" under these provisions shall do so in writing to the Registrar. Any such application shall be considered 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.

(vii) The Vice-Chancellor may on the recommendation of the Professorial Board 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 Board and the Vice-Chancellor, the student's lack of fitness to pursue the course nominated.

(viii) A student who has failed, under the provisions of Clause (vi) of these rules, to show cause acceptable to the Professorial Board 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.

(ix) A student may appeal to an Appeals Committee constituted by Council for this purpose, against his exclusion by the Professorial Board from any subject or course.

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.

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 Chief Steward 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 (Bursar's Division). 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 Centre 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 Bio-Medical Library is in the Biological Sciences building with a branch at Prince Henry Hospital ('phone: 661-0111). There are also branches at Broken Hill and Wollongong.

The University Union

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

Student Accommodation

Residential Colleges

Accommodation for students is provided within the complex of the Residential Colleges of the University which comprises Basser College, Goldstein College, and Philip Baxter College. The College complex houses 500 men and women students, as well as staff members. Tutors in residence provide tutorial assistance in a wide range of subjects. Board and residence fees, which are payable on a term basis, amount to $18.50 per week. Intending students should apply in writing to the Master, Box 24, Post Office, Kensington, N.S.W. 2033, from whom further information is available.

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 $20.00 per week. An Anglican college will open in 1969, and a Roman Catholic college is under construction.

Other Accommodation

Students requiring other than Residential College accommodation may make personal application to the Student Amenities Service where current lists are kept of accommodation available at recognised 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 recognised 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.

Omnibus: Concessions are available to:

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

(b) 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.

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.

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

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

Location:

The Student Amenities Service at Kensington is located opposite the Basser College end of the new Electrical Engineering Building. (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 Service

This Service is provided for the benefit of students and staff by five Christian Churches (Anglican, Roman Catholic, Methodist, Baptist, 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 enrolled students, free of charge, between 9 a.m. and 5 p.m., Mondays to Fridays, and, in addition, from 6 p.m. to 8 p.m., Tuesdays to Thursdays during term.

The medical service is diagnostic, and in most instances therapeutic, but it 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 may be referred to his own doctor or to an appropriate hospital for specialist opinion 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 all 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.

Student Loan Fund

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 Mr. J. B. Rowe, 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 notification 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 twenty-five 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 twenty-five 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 $559 per annum or $852.80 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 Officer-in-Charge, Sydney Office, Department of Education and Science, 70 Castlereagh Street, Sydney, 2000, or Box 3987, G.P.O., Sydney, 2001 (Telephone: 25-5447).

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. Applications must be lodged after publication of examination results and after the announcement of the award of Commonwealth University Scholarships, but not later than 31st January.

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.

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.

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.

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 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.

Brick Manufacturers' Scholarship in Ceramic Engineering

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

New South Wales State Brickworks Scholarship in Ceramic Engineering

The State Brickworks of the Department of Public Works of New South Wales has made available an undergraduate 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.

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.

Available in alternate years (next available in 1970).

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

The Commonwealth Industrial Gases Ltd. has undertaken to provide scholarships 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. One scholarship will be offered each year: it will be tenable for a maximum of four years, and will have a value of $1,000 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.

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 $600 p.a., plus University fees, and is tenable for the duration of the course. Applications should be made to the Company, Gold Fields House, Sydney Cove.

The John Heine Memorial Scholarship

This scholarship is designed to assist students to undertake the final two years of the degree course in Mechanical, Electrical, or Chemical Engineering, Applied Chemistry, Metallurgy, or Physics. Applicants must have qualified for admission to the third year of the course (fourth year for Chemical Engineering). The scholarship has a maximum total value of $700. Applications should be made not later than 31st January each year to the Secretary, The John Heine Memorial Foundation, c/o the Metal Trades Employers' Association, 101 Walker Street, North Sydney.

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 $850 p.a. for adults and from $560 to $850 p.a. for juniors, plus University fees and allowances. Applications to The Secretary, Public Service Board, Box 2, G.P.O., Sydney, 2001.

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 offers bursaries to students who are British subjects and who have completed the first year of the B.E. course in Mining Engineering or of the B.Sc. course in Applied Geology or Metallurgy, with a minimum of one distinction or two credits. The bursaries have a value of $100 per annum, and 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 have completed at least one full-time year of the degree course in any branch of Engineering, Metallurgy, or Applied Science. Preference is given to Commonwealth Scholarship holders. Students receive an annual grant with increments in successive years. The tenure of the scholarships is for the duration of the course. Application should be made to the nearest office of the Broken Hill Pty. Co. Ltd., or its subsidiaries.

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 $1,200 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.

Overseas Companies Scholarships in Mining Engineering

A number of overseas 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: Cominco Ltd., 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.

Scholarships Available to Broken Hill residents and/or to Children of Company Employees

A number of mining companies operating in the Broken Hill district offer scholarships, tenable in any degree course, to students who are residents of Broken Hill, and/or to the children of Company employees. The companies are:

Broken Hill South Ltd., Broken Hill.

Zinc Corporation Ltd., P.O. Box 444, Broken Hill.

New Broken Hill Consolidated Ltd., P.O. Box 444, Broken Hill.

The Southern Power Corporation Pty. Ltd., P.O. Box 444, Broken Hill, N.S.W.

Applications should be made to the office of the appropriate Company.

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: Universal Textiles (Aust.) Ltd., Bradford Cotton Mills Ltd., Bond's Industries Ltd., Felt and Textiles of Australia Ltd., Fibremakers Ltd., Prince-Smith and Stells 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 Technology Scholarships

Several firms and banks associated with the wool industry endow scholarships in courses leading to the Bachelor of Science degree in Wool Technology. The Scholarships now current have been made available by William Cooper & Nephews (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, Geigy Aust. Pty. Ltd., Sunbeam Corporation Ltd., and others. Valued from $600 to $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 Technology.

Wool Research Trust Fund Scholarships in Wool Technology and Textile Technology

A number of scholarships for courses in Wool Technology and Textile Technology have been made available by the Wool Research Trust Fund (Commonwealth Government). The scholarships provide an allowance of $800 per annum for living expenses for four years, and successful applicants may hold a Commonwealth Scholarship concurrently.

FACULTY REGULATIONS

RULES OF PROGRESSION

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

1. No full-time student (except those in the Science course, the Arts course, or in the Commerce course) 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 are offered in Food Technology, Industrial Chemistry, Ceramic Engineering, Polymer Science, Applied Geography, Metallurgy, Applied Geology, Textile Technology and Wool Technology leading to the degree of Bachelor of Science. Four-year courses in Chemical Engineering, Fuel Engineering and Mining Engineering are offered, leading to the degree of Bachelor of 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 vacation. In the case of Wool Technology 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 ninety 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, Fuel Engineering, Food Technology, Industrial Chemistry, Ceramics, Polymer Science, Metallurgy, and Mining Engineering (Wollongong and 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 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 now publishes its own handbook which is available free of charge. All details regarding general studies courses and requirements are contained in their handbook, 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 three figures for each subject indicate the number of hours spent each week in lectures, tutorials and laboratory work respectively. The fourth 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 Engineering I, Materials and Structures, Soil Mechanics, Mining and Mineral Process Engineering. A course in Surveying and courses in 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 thirty weeks per year on a three-term basis, the third term of the fourth year being 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

First Year

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Prac.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
25.001	Geology I*	2	0	4	4
		11	3	10	16½

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

Second Year

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Prac.	Private Study
1.212	Physics IIT (Units B and C)	1½	½	1	2
2.022	Chemistry II (M)*	3	0	2½	5
5.001/1	Engineering I, Part I†	2	0	3	3½
10.031	Mathematics	1	1	0	2
25.002	Geology II‡	4	0	5	6
	General Studies Elective	1	½	0	2
		12½	2	11½	20½
	* Hours for Terms 1 and 3 only. Hours for Term 2	4	0	3	6½
	† Hours for Terms 1 and 2 only. Hours for Term 3	1	0	1	1½
	‡ Hours for Terms 1 and 2 only. Hours for Term 3	4	4	1	6

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

THIRD YEAR

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
8.112	Materials and Structures	1	1	1	1½
8.243S	Soil Mechanics	1	0	1	2
10.331	Statistics	1	0	1	1½
25.003/1	Geology III (Part 1) *				
25.003/2	Geology III (Part 2)	7	0	6	16
25.003/3	Geology III (Part 3)				
	Two General Studies Electives	2	1	0	4
		12	2	9	25

Fieldwork is an essential part of the course. It includes approximately one week's geological survey camp, which may be held before First Term, at least one other field session of approximately one week, and a one-day Geophysics field tutorial. In all, up to three weeks may be spent in the field.

* Hours for Term 1 only.

Hours for Term 2	7	2	5	16
Hours for Term 3	5	2	5	12

FOURTH YEAR

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Prac.	Private Study
*7.551	Mining and Mineral Process Engineering†	2	2	0	2
*8.441	Engineering Surveying	1½	0	1½	3
*25.004/1	Geology IV (Part 1) ‡				
*25.004/2	Geology IV (Part 2)	5	2	4	13
*25.004/3	Geology IV (Part 3)				
*25.004/4	Geology IV (Part 4) (Project)**	0	4	0	0
	General Studies Advanced Elective§	3	0	0	6
		11½	8	5½	24

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

* These courses run for 24 weeks.

† Hours for Term 1 only.

Hours for Terms 2 and 3	1	0	3	3

‡ Hours for Term 1 only.

Hours for Term 2	5	1	7	15
Hours for Term 3	6	1	7	15

** Hours for Term 1 only.

Hours for Term 3	0	0	10	40

In the last six weeks of Term 3, students should spend 10 hours per week in laboratory and other supporting work on the Project; 40 hours (approx.) will be devoted to field work.

§ Terms 1 and 2 only.

SCHOOL OF CHEMICAL ENGINEERING

The School offers courses in Chemical Engineering, Fuel Engineering and Food Technology, and at graduate level in Biological Process Engineering.

Chemical engineering is the application of the principles of the physical sciences, together with the principles of economics and human relations, to fields in which matter undergoes a change in state, energy content or composition. The chemical engineer is generally responsible for the design, construction and operation of plant and equipment used in the chemical processing industries.

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. The industrial future of a nation is largely dependent on the success of its fuel industries, on which all other industries depend. In Australia, fuel and combustion engineers are needed in a wide and varied field of activity: in management and design, in supervision and control of equipment to maintain optimum performance, in technical services and air pollution control, and in research and development to seek better and more efficient methods of energy production and utilization.

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

This course extends over four years and students study full-time during the day for thirty weeks of each year (excluding examination and vacation 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.

First Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

Second Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT	1½	½	1	2
2.002	Chemistry II (S)*	4	0	5	7
3.111	Chemical Engineering I	1	3	0	2
3.311	Fuel Science and Engineering I	2	0	0	2
8.112	Materials and Structures	1	1	1	1½
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	1½
	General Studies Elective	1	½	0	2
		12½	7	7	20
	* Hours for Terms 1 and 3 only. Hours for Term 2	5	0	4	9

THIRD YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.121	Chemical Engineering IIA	4	2	0	5
3.122	Chemical Engineering IIB	6	3	3	10
6.801	Electrical Engineering	1	0	2	2
10.032	Mathematics	1	1	0	2
	Two General Studies Electives	2	1	0	4
		14	7	5	23

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.131	Chemical Engineering IIIA*	2	2	6	8
3.132	Chemical Engineering IIIB*	6	4	3	12
	Design Thesis *or* Experimental Thesis†	0	3	0	0
	General Studies Advanced Elective	2	0	0	4
		10	9	9	24
	* Terms 1 and 2 only. † Hours for Terms 1 and 2 only. Hours for Term 3	0	0	15	29

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. It extends over six years of part-time study.

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 covers approximately the same subject matter as the first three years of the full-time 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-

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

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.

First and Second Stages

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

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

Third Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT	1½	½	1	2
2.002	Chemistry II (S)*	4	0	5	7
	General Studies Elective	1	½	0	2
		6½	1	6	11
	* Terms 1 and 3 only. Hours for Term 2	5	0	4	9

Fourth Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.111	Chemical Engineering I	1	3	0	2
3.311	Fuel Science and Engineering I	2	0	0	2
8.112	Materials and Structures	1	1	1	1½
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	1½
		6	6	1	9

Fifth Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.121	Chemical Engineering IIA	4	2	0	5
6.801	Electrical Engineering	1	0	2	2
10.032	Mathematics	1	1	0	2
	General Studies Elective	1	½	0	2
		7	3½	2	11

Sixth Stage*
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.122	Chemical Engineering IIB	6	3	3	10
	General Studies Elective	1	½	0	2
		7	3½	3	12

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:

22.111 Industrial Chemistry I
22.211 Ceramics I
22.311 Polymer Science I
4.011 Metallurgy I
7.311 Mineral Processing
3.321 Fuel Engineering II
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.

* Students are required also to sit for an examination embracing the principles of unit operations and of design at the end of the sixth year (3.123 Combined Chemical Engineering Examination).

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 power 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.

The Council of the Institute of Fuel has accepted the degree courses in Fuel Engineering 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 recognised qualification for admission to corporate membership.

Successful completion of degree courses is also recognized as sufficient qualification for corporate membership of the Institution of Engineers, Australia.

Fuel Engineering—Full-Time Course

Bachelor of Engineering

The full-time undergraduate course, which leads to the degree of Bachelor of Engineering, is planned to emphasize the importance of scientific principles and their application in practice. The course extends over four years and students study full-time during the day. The training in the first three years is almost identical with that of the first three years in the Chemical Engineering course and consists essentially 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 required 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.

First Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

Second Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT	1½	½	1	2
2.002	Chemistry II (S)*	4	0	5	7
3.111	Chemical Engineering I	1	3	0	2
3.311	Fuel Science and Engineering I	2	0	0	2
8.112	Materials and Structures	1	1	1	1½
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	1½
	General Studies Elective	1	½	0	2
		12½	7	7	20
	* Hours for Terms 1 and 3 only. Hours for Term 2	5	0	4	9

THIRD YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.121	Chemical Engineering IIA	4	2	0	5
3.122	Chemical Engineering IIB	6	3	3	10
3.321	Fuel Engineering II*	2	0	1	2
6.801	Electrical Engineering	1	0	2	2
	Two General Studies Elective	2	1	0	4
		15	6	6	23

* 10.032 Mathematics may be substituted.

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.331*	Fuel Engineering IIIA	4	2½	4	8
3.332*	Fuel Engineering III B	4	2½	4	8
3.340†	Projects	0	3	0	2
	General Studies Advanced Elective	2	0	0	4
		10	8	8	22
	* Terms 1 and 2 only.				
	† Hours for Terms 1 and 2 only. Hours for Term 3	0	1	20	20

Students who have taken 10.032 Mathematics in third year will have to take the subject 3.321 Fuel Engineering II as part of their assignments.

Fuel Engineering—Part-Time Course*

Bachelor of Science (Technology)

The part-time course, leading to the B.Sc.(Tech.) degree in Fuel Engineering, is of six years' duration. It is designed to meet the needs of persons engaged in the fuel industry who desire to obtain formal educational training in this technology. Candidates for this degree are required to complete an approved programme of industrial training over a period of not less than three years, concurrently with attendance in the course.

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

First and Second Stages
(30 weeks' part-time course)

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

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

Third Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT	1½	½	1	2
2.002	Chemistry IIS*	4	0	5	7
	General Studies Elective	1	½	0	2
		6½	1	6	11
	* Hours for Term 1 only.				
	Hours for Term 2	5	0	4	9
	Hours for Term 3	4	0	5	7

Fourth Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.111	Chemical Engineering I	1	3	0	2
3.311	Fuel Science and Engineering I	2	0	0	2
8.112	Materials and Structures	1	1	1	1½
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	1½
		6	6	1	9

Fifth Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.121	Chemical Engineering IIA	4	2	0	5
3.321	Fuel Engineering II	2	0	1	2
6.801	Electrical Engineering	1	0	2	2
	General Studies Elective	1	½	0	2
		8	2½	3	11

Sixth Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.333	Fuel Engineering IIIM	5	3	4	10
	General Studies Elective	1	½	0	2
		6	3½	4	12

Fuel Engineering B.Sc. (Tech.) in Full-Time/Part-Time Study

Students enrolling in the Fuel 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

Report and Seminar ..... 3 hours
Elective subjects ..... 4 to 6 hours

The students taking the accelerated B.Sc.(Tech.) degree course may select subjects from existing Fuel subjects or the following list to the extent of a total weekly allocation of 4 to 6 hours.

22.211/1	Ceramics IA	3 hours
22.221	Chemical Thermodynamics and Kinetics	3 hours
4.931S	Metallurgy	1½ hours
18.111	Industrial Administration	2 hours
18.321	Methods Engineering	2 hours
14.041	Industrial and Commercial Law	2 hours
3.122/2	Chemical Engineering IIB (Design I)	4 hours
3.121/2	Chemical Engineering IIA (Management and Data Processing)	1 hour

Selection from the above list will be subject to students possessing the necessary pre-requisites and to the availability of the courses.

The topic for the report will be submitted to the Head of the Department for approval before the end of the third week of the First Term. The report may take the form of a literature survey or a topic connected with the student's employment activities.

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, 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 the B.Sc. course 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 familiarise 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.

First Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
10.011 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
17.001	General and Human Biology	2	0	4	4
		11	3	10	16½

Second Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.002	Chemistry II (S)*	4	0	5	7
3.111/1	Chemical Engineering I— Principles I	1	1	0	2
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	1½
41.111	Biochemistry†	3	0	6	6
	General Studies Elective	1	½	0	2
		11	3½	11	20½
	* Hours for Terms 1 and 3 only. Hours for Term 2	5	0	4	9

† There is no laboratory work in third term.

THIRD YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.261	Applied Organic Chemistry	2	0	4	3½
3.211	Food Technology I (Part 1)*	1½	0	3	3½
3.212	Food Technology I (Part 2)†	4	0	8	10
3.231	Chemical Engineering	2	0	0	4
44.101/1	Microbiology I (Part I)‡	4	0	8	10
	Two General Studies Electives	2	1	0	4
		11½	1	15	25

* Includes 43.111 Botany.
† Operates for **second** fifteen weeks of academic year.
‡ Operates for **first** fifteen weeks of academic year.

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.221	Food Technology II*	3	0	4	6
3.222	Project	0	0	8	4
	General Studies Advanced Elective	2	0	0	4
		5	0	12	14
Plus *one* Elective from—					
41.112	Biochemistry†	3	0	10	7
44.101/2	Microbiology I, Part II‡	4	0	8	10

* Includes 45.211 Entomology.
† Operates for **first** fifteen weeks of academic year.
‡ Operates for **second** fifteen weeks of academic year.
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.

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.

First and Second Stages

Two of the following subjects will be taken in first year and the other two in second year (as directed):

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
17.001	General and Human Biology	2	0	4	4
		11	3	10	16½

Third Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.002	Chemistry II (S)*	4	0	5	7
10.031	Mathematics	1	1	0	2
	General Studies Elective	1	½	0	2
		6	1½	5	11
	* Hours for Terms 1 and 3 only. Hours for Term 2	5	0	4	9

FOURTH STAGE
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.111/1	Chemical Engineering I—Principles I	1	1	0	2
10.331	Statistics	1	1	0	2
41.111	Biochemistry*	3	0	6	6
		5	2	6	10

* There is no laboratory work in Term 3.

FIFTH STAGE
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.261	Applied Organic Chemistry	2	0	4	3½
3.211	Food Technology I (Part 1)*	1½	0	3	3½
3.231	Chemical Engineering	2	0	0	4
	General Studies Elective	1	½	0	2
		6½	½	7	13

* Includes 43.111 Botany.

SIXTH STAGE
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.212	Food Technology I (Part 2)*	4	0	8	10
44.101/1	Microbiology I (Part 1)†	4	0	8	10
	General Studies Elective	1	½	0	2
		5	½	8	12

* Operates for **second** fifteen weeks of academic year.
† Operates for **first** fifteen weeks of academic year.

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:

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

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

SCHOOL OF CHEMICAL TECHNOLOGY

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

The second years of the courses in Industrial Chemistry, Ceramic Engineering and Polymer Science have been revised, and in line with this development, the third years of these courses will be revised in 1970. Stage 3 and Stage 4 of the part-time courses have also been revised: later stages will be revised in 1970.

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.

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.

DEPARTMENT OF POLYMER SCIENCE

The Department of Polymer Science provides courses in Polymer Science designed to train scientists fitted for service in industries concerned with surface coatings, plastics and rubber (natural and synthetic). Graduates from these courses would be capable of satisfactorily applying their training in the following functions in these industries: research and development, production control, quality control, product evaluation and technical sales and service.

Industrial Chemistry—Full-Time Course
Bachelor of Science

FIRST YEAR

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
Plus one of:—					
5.001	Engineering I	3	3	0	4½
17.001	General Biology	2	0	4	4
25.001	Geology I*	2	0	4	4

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

SECOND YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT (Unit B)*	1	0	2**	2
2.311	Physical Chemistry	1½	½	2½	3
2.411	Inorganic Chemistry	1	½	2½	3
2.611	Organic Chemistry	1½	½	2½	3
10.031	Mathematics II	1	1	0	2
10.331	Statistics	1	1	0	1½
22.111	Industrial Chemistry I	2	0	2	1
	General Studies Elective	1	½	0	2
		10½	4	11½	18

* 15 weeks' course.
** Includes tutorials.

THIRD YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.211	Applied Organic Chemistry	1	0	3	2½
3.111	Chemical Engineering I	2	2	0	2
3.311	Fuel Science and Engineering I	2	0	0	2
22.111	Industrial Chemistry I	7½	2	2½	14
	Two General Studies Electives	2	1	0	3
		14½	5	5½	23½

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
22.112	Industrial Chemistry II*	8	0	4	16
22.121	Industrial Chemistry Seminar	0	3	0	5
22.191	Project†	0	0	3	3
	General Studies Advanced Elective	2	0	0	4
		10	3	7	28
	* Hours for Terms 1 and 2 only. Hours for Term 3	2	0	0	4
	† Hours for Term 1 only. Hours for Term 2	0	0	6	3
	Hours for Term 3	0	0	27	3

Industrial Chemistry—Part-Time Course*

Bachelor of Science (Technology)

First and Second Stages

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

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
Plus one of:—					
5.001	Engineering I	3	3	0	4½
17.001	General Biology	2	0	4	4
25.001	Geology I†	2	0	4	4

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

Third Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT (Unit B)*	1	0	2†	2
2.311	Physical Chemistry	1½	½	2½	3
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	1½
	General Studies Elective	1	½	0	2
		5½	3	4½	10½

* 15 weeks' course.
† Includes tutorials.

Fourth Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.451	Inorganic/Analytical Chemistry	2	0	3	3½
2.611	Organic Chemistry	2	0	3	3½
	General Studies Elective	1	½	0	2
		5	½	6	9

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

FIFTH STAGE
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.111	Chemical Engineering I	2	2	0	2
3.311	Fuel Science and Engineering I	2	0	0	2
22.111/1	Industrial Chemistry I (Part I)	2½	0	2½	6
	General Studies Elective	1	½	0	1½
		7½	2½	2½	11½

SIXTH STAGE
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.211	Applied Organic Chemistry	1	0	3	2½
22.111/2	Industrial Chemistry I (Part I)	5	2	0	8
	General Studies Elective	1	½	0	1½
		7	2½	3	12

Ceramic Engineering—Full-Time Course
Bachelor of Science

FIRST YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

Second Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT (Units B and C)	1½	½	1	2
2.311	Physical Chemistry	1½	½	2½	3
2.411	Inorganic Chemistry	1	½	2½	3
2.511	Analytical Chemistry	1	0	3	3
8.112	Materials and Structures	1	1	1	1½
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	2
	General Studies Elective	1	½	0	2
		9	5	10	18½

Third Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.111	Chemical Engineering I	2	2	0	2
3.311	Fuel Science and Engineering I	2	0	0	2
8.112	Materials and Structures	1	1	1	1½
22.211	Ceramics I	3	0	5	7
22.221	Chemical Thermodynamics and Kinetics	2	1	0	3
25.201	Mineralogy	1	0	2	2
	Two General Studies Electives	2	1	0	3
		13	5	8	20½

Fourth Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
22.212	Ceramics II	3	0	3	6
22.231	Ceramic Engineering	2	0	2	4
22.241	Instrumentation Process Control*	3	0	4	5
22.251	Operation Research and Seminars	1	0	0	2
22.291	Project†	0	0	6	3
	General Studies Advanced Elective*	2	0	0	4
		11	0	15	24

* Terms 1 and 2 only.
† In Term 3, 18 hours per week are devoted to laboratory work on the Project.

Ceramics—Part-Time Course*

Bachelor of Science (Technology)

First and Second Stages

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

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

Third Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT (Units B and C)	1½	½	1	2
2.311	Physical Chemistry	1½	½	2½	3
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	2
		5	3	3½	9

Fourth Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.411	Inorganic Chemistry	1	½	2½	3
2.511	Analytical Chemistry	1	0	3	3
8.112	Materials and Structures	1	1	1	1½
	General Studies Elective	1	½	0	2
		4	2	6½	9½

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

Fifth Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
8.112	Materials and Structures	1	1	1	1½
22.211/1	Ceramics I (Part I)	1	0	2	2
22.221	Chemical Thermodynamics and Kinetics	2	1	0	3
25.201	Mineralogy	1	0	2	2
	General Studies Elective	1	½	0	1½
		6	2½	5	10

Sixth Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.111	Chemical Engineering I	2	2	0	2
3.311	Fuel Science and Engineering I	2	0	0	2
22.211/2	Ceramics I (Part II)	2	0	3	5
	General Studies Elective	1	½	0	1½
		7	2½	3	10½

Polymer Science—Full-Time Course
Bachelor of Science

First Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

SECOND YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT (Unit B)*	1	0	2**	2
2.311	Physical Chemistry	1½	½	2½	3
2.411	Inorganic Chemistry	1	½	2½	3
2.511	Analytical Chemistry	1	0	3	3
2.611	Organic Chemistry	1½	½	2½	3
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	2
	General Studies Elective	1	½	0	2
		9	4	12½	20

* 15 weeks' course
** Includes tutorials

THIRD YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.322	Physical Chemistry	2	0	3	4½
2.632	Organic Chemistry	2	0	3	4½
3.111/1	Chemical Engineering I (Principles I)	1	1	0	1
22.311	Polymer Science I	3	0	6	8
	Two General Studies Electives	2	1	0	3
		10	2	12	21

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.331	Applied Physical Chemistry	1	0	3	2½
22.312	Polymer Science II (Terms 1 and 2 only)*	4	0	9	12
22.321	Seminar (Terms 1 and 2)	0	2	0	3
22.391	Project†	0	0	3	3
	General Studies Advanced Elective**	2	0	0	4
		7	2	15	24½
	* Hours for Term 1 only. Hours for Term 2	4	0	8	12
	† Hours for Term 1 only. Hours for Term 2	0	0	6	3
	Hours for Term 3	0	0	30	6

** Hours for terms 1 and 2.

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

First and Second Stages

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

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

Third Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT (Unit B)*	1	0	2**	2
2.311	Physical Chemistry	1½	½	2½	3
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	2
	General Studies Elective	1	½	0	2
		5½	3	4½	11

* 15 weeks' course
** Includes tutorials

Fourth Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.451	Inorganic/Analytical Chemistry	2	0	3	3½
2.611	Organic Chemistry	2	0	3	3½
	General Studies Elective	1	½	0	2
		5	½	6	9

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

FIFTH STAGE
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.322	Physical Chemistry	2	0	3	4½
2.632	Organic Chemistry	2	0	3	4½
	General Studies Elective	1	½	0	1½
		5	½	6	10½

SIXTH STAGE
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
3.111/1	Chemical Engineering I (Principles I)	1	1	0	1
22.311	Polymer Science I	3	0	6	8
	General Studies Elective	1	½	0	1½
		5	1½	6	10½

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

Students enrolling in the B.Sc.(Tech.) courses in Industrial Chemistry, Ceramics or Polymer Science 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 School of Chemical Technology:

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

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

First Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.001 / 2.011	Chemistry I *or* Higher Chemistry I	2	0	4	5
10.001 / 10.011	Mathematics I *or* Higher Mathematics I	4	2	0	4
17.001	General and Human Biology	3	1	2	4
27.001	Applied Geography I*	2	1	3	4
		11	4	9	17

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

Second Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
10.331	Statistics	1	1	0	1½
17.101A	Chemistry of Biologically Important Molecules**	3	0	3	6
43.101C	Plant Physiology**				
27.002	Applied Geography II†	2	1*	3	6
	General Studies Elective	1	½	0	2

* Terms 2 and 3 only.
** 15 weeks' course.
† Up to 5 days field tutorials are an essential part of this course.

Third Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
43.101B	Plant Morphology*†	3	0	3	6
43.102B	Advanced Plant Physiology and Biochemistry*	3	0	3	6
43.102E	Environmental Botany*†	3	0	3	6
27.003	Techniques in Physical Geography*‡	4	1	6	6
27.013	Environmental Relationships in Physical Geography*	3	0	3	4
	Two General Studies Electives	2	1	0	4

* 15 weeks' course.
† Field work is an essential part of the course.
‡ Up to 4 days' field tutorial are an essential part of the course.

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
9.231	Pastoral Agronomy	2	0	0	2
27.204	Advanced Biogeography*†	3	1	4	6
27.504	Project (Biogeography)**	0	0	2	2
	Biological Sciences Elective***	3	0	3	6
	General Studies Advanced Elective	1	½	0	4

* 21 weeks' course, prerequisite 17.302E Environmental Botany.
** Hours for Terms 1 and 2 only; Term 3 10 hours per week.
*** 15 weeks' course.
† Up to 9 days' field tutorials are an essential part of the course.

GEOMORPHOLOGY AND PEDOLOGY

FIRST YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.001 2.011	Chemistry I *or* Higher Chemistry I	2	0	4	5
10.001 10.011	Mathematics I *or* Higher Mathematics I	4	2	0	4
17.001	General and Human Biology	3	1	2	4
27.001	Applied Geography I*	2	1	3	4
		11	4	9	17

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

SECOND YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
10.331	Statistics	1	1	0	1½
25.001	Geology I**	2	0	4	4
27.002	Applied Geography II***	2	1†	3	6
	General Studies Elective	1	½	0	2
		9	3½	9	17

** Three field tutorials, up to 5 days in all, are an essential part of the course.
*** Up to 5 days' field tutorials are an essential part of the course.
† Terms 2 and 3 only.

THIRD YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
25.002	Geology II**	4	0	5	6
27.003	Techniques in Physical Geography*†	4	1	6	6
27.013	Environmental Relationships in Physical Geography*	2	1	3	4
27.403	Geomorphology and Pedology*†	3	0	3	4
	Two General Studies Electives	2	1	0	3
		10/11	2	11	15/17

* 15 weeks' course.
† Up to 4 days' field tutorials are an essential part of the course.
** Fieldwork, up to 2 weeks in all, is an essential part of the course. It includes a field training period of approx. one week.

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
8.243S	Soil Mechanics***	1	0	1	1½
25.013	Geology III (Supplementary)*	2	0	2	3
27.404	Advanced Geomorphology and Pedology***†	4	1	6	11
27.504	Project (Geomorphology and Pedology)**				
	General Studies Advanced Elective	2	0	0	4
		9	1	9	19½

*** 21 weeks' course.
† A field tutorial of one week is an essential part of the course.
** In Term 3 only, and consisting of 11 hours of laboratory work.
* Selected strands in Geochemistry, Sedimentary Petrology and Clay Mineralogy.

ECONOMIC GEOGRAPHY

Interim Programme for First-Year Students Registered in 1968

SECOND YEAR (1969 only)
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
10.331	Statistics	1	1	0	2
15.101	Economics I	2	1	0	3
27.002	Applied Geography II*	2	1†	3	6
53.111	Sociology I	2	2	0	4
	General Studies Elective	1	1½	0	2
		8	5½	3	17

† Terms 2 and 3 only.
* Up to 5 days' field tutorials are an essential part of the course.

THIRD YEAR (1970 only)
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
15.102	Economics II	2	2	0	4
27.303	Theory of Urban Settlement†	2	1	3	4
27.313	Location Theory†	2	1	3	4
27.323	Transport and Marketing Geography†	4	2	3	8
53.112	Sociology II	4½	1	0	6
		10½	5	6/3	18

† 15 weeks' course.

FOURTH YEAR (1971 only)
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
11.471	Planning Law and Administration	2	0	0	2
15.103	Economics III	2	1	0	3
15.243	Economic Development	1	1	0	2
27.304	Advanced Urban Geography*	2	1	2	8
27.504	Project (Economic Geography)**	0	0	3	8
		7/5	1/0	5	15

* 21 weeks' course.
** Hours for First and Second Terms only. Third Term 8 hours per week.

ECONOMIC GEOGRAPHY—(Programme from 1969)

FIRST YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
10.001 10.001	Mathematics I *or* Higher Mathematics I	4	2	0	4
15.101	Economics I	2	1	0	3
17.001	General and Human Biology	2	0	4	4
27.001	Applied Geography I*	2	1	3	4
		10	4	7	15

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

SECOND YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
15.102	Economics II	2	2	0	4
10.331	Statistics	1	1	0	2
27.002	Applied Geography II*	2	1†	3	6
28.101	Principles of Marketing	2	1	0	3
53.111	Sociology I	2	2	0	4
		9	7	3	19

† Terms 2 and 3 only.
* Up to 5 days' field tutorials are an essential part of the course.

THIRD YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
15.103	Economics III	1	1	0	3
27.303	Theory of Urban Settlement†	2	1	3	6
27.323	Transport and Marketing Geography†	4	2	3	8
27.313	Location Theory†	2	1	3	6
28.102	Case Studies in Marketing	2	1	0	3
53.112	Sociology II	4½	1	0	6

† 15 weeks' course.

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
11.471	Planning Law and Administration	2	0	0	2
15.243	Economic Development	1	1	0	2
27.304	Advanced Urban Geography*	2	1	2	8
27.504	Project (Economic Geography)**	0	0	3	0
12.001	Psychology I *or*	3	2	0	4
51.111	History I *or*	2	1	0	3
54.111	Political Science	2½	1	0	3

* 21 weeks' course.
** Hours for First and Second Terms only. Third Term 8 hours per week.

GEOGRAPHY IN OTHER FACULTIES

First Year 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)

It is proposed to introduce third year studies in 1970, enabling students to major in Geography in Arts and Commerce. Course outlines for third years will appear in the Calendar for 1970.

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 metal extraction plants of Newcastle, Port Kembla, Broken Hill, Mt. Isa, Mt. Morgan, Port Pirie, Whyalla or Tasmania; 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 30 weeks over three terms from March to November (excluding examinations and vacations).

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.

First Year

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 or 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
10.011 or 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
Plus one of					
5.001	Engineering I	3	3	0	4½
25.001	Geology I	2	0	4	4

SECOND YEAR (1968 only)
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.022	Chemistry II (M)*	2½	0	3½	5
4.011	Metallurgy I†	5	0	5	8
4.031	Physics of Metals**	1	0	3	2
10.031	Mathematics	1	1	0	2
25.201	Mineralogy *or*	1	0	1	2
5.001	Engineering I (Part A)	2	0	0	2
	General Studies Elective	1	½	0	2
	* First half of year ..... Lecture 3 hours Practical 3 hours				
	Second half of year .... Lecture 2 hours Practical 4 hours				
	† Hours for Term 1 only.				
	Hours for Term 2	6	1	4½	8
	Hours for Term 3	4	1	5	7
	** Hours for Term 1 only.				
	Hours for Terms 2 and 3	1	0	0	2

THIRD YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
4.012	Metallurgy II	9	1*	9	17
6.801	Electrical Engineering	1	0	2	2
	Two General Studies Electives	2	1	0	4
		12	2	11	23

* Two hours in terms 2 and 3.

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
4.013	Metallurgy III*	6	2	9	13½
4.021	Metallurgy Project†	0	0	5	5
	General Studies Advanced Elective	2	0	0	4
		8	2	14	22½
	* Hours for Term 1 only.				
	Hours for Term 2	6	2	6	13
	Hours for Term 3	6	0	0	12
	† Hours for Term 1 only.				
	Hours for Term 2	0	0	8	8
	Hours for Term 3	0	0	12	12

Metallurgy—Part-Time Course‡

Bachelor of Science (Technology)

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

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

First and Second Stages

(30 weeks' part-time course)

(Two subjects to be taken in each year)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
Plus one of					
5.001	Engineering I	3	3	0	4½
25.001	Geology I	2	0	4	4

Third Stage

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.022	Chemistry II (M)*	2½	0	3½	5
4.031	Physics of Metals†	1	0	3	2
10.031	Mathematics	1	1	0	2
	General Studies Elective	1	½	0	2
		6½	2	3½	11

* First half of year ..... Lecture 3 hours Practical 3 hours
Second half of year .... Lecture 2 hours Practical 4 hours

† Hours for Term 1 only.

Hours for Terms 2 and 3	1	0	0	2

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

Fourth Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
4.011	Metallurgy I*	5	0	5	8
25.201	Mineralogy *or*	1	0	1	2
5.001	Engineering I (Part A)	2	0	0	2
		6	0	6	10
	* Hours for Term 1 only.				
	Hours for Term 2	6	1	4½	8
	Hours for Term 3	4	1	5	7

Fifth Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
4.012/1	Metallurgy IIA*	4	0	5	8
6.801	Electrical Engineering	1	0	2	2
	General Studies Elective	1	½	0	2
		6	½	7	12
	* Hours for Terms 1 and 2 only.				
	Hours for Term 3	4	2	3	8

Sixth Stage
(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
4.012/2	Metallurgy IIB	5	1	5	10
	General Studies Elective	1	½	0	2
		6	1½	5	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 three terms			
	Lec.	Tut.	Lab.	Private Study
4.012/3 Metallurgy IIC	2	0	2	3½
4.013/1 Seminar	0	0	1	1
4.012/4 Report	0	0	0	2
	2	0	3	6½

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, leading to the award of the B.Sc. (Tech.) degree, are conducted at the Wollongong University College and at the W. S. & L. B. Robinson University College, Broken Hill. Students in the B.Sc. (Tech.) course may complete the requirements for the Bachelor of Engineering degree at Kensington after obtaining the approval of the Head of the School.

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, now ranging second in Australia, 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 established 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 vacations obtaining practical experience in mines. The minimum requirement is ninety days' industrial experience. 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.

First Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.001 / 1.031	Physics I *or* Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I or Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

Second Year
(30 weeks' day course)

		Hours per week for three terms		
		Lec.	Lab./Tut.	Private Study
6.801	Electrical Engineering	1	2	3
7.110	Mineral Resources	1	0	1
8.151	Mechanics of Solids	2	1	3
8.251	Properties of Materials	1½	1½	3
8.441	Engineering Surveying*	1½	1½	2
8.511	Hydraulics	1½	1½	3
10.022	Mathematics	3	1	4
25.101	Geology for Engineers†	1	1½	2
	General Studies Elective	1	½	2
		13½	10½	23

* A one-week Survey Camp must be attended in third term.
† Two one-day Geology excursions are an essential part of the course.

Third Year*
(21 weeks' day course)

		Hours per week for two terms			
		Lec.	Tut.	Lab.	Private Study
7.111S	Mining Engineering I	5	1	4	8
7.121S	Mine Surveying	1	0	1	1½
7.551S	Mining and Mineral Process Engineering (Part 2)	1	0	1	2
25.102S	Geology for Mining Engineering	4	0	3	6
	Two General Studies Electives	2½	1½	0	5
		13½	2½	9	22½

* A Geology excursion will be conducted during the year.

FOURTH YEAR
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
7.112	Mining Engineering II (Part 1)	1	1	0	2
7.112	Mining Engineering II (Part 2) *or* 7.312 Mineral Processing II	3	0	5	8
7.113	Mineral Industry Elective Project*	0	1	4	5
7.311	Mineral Processing I	2	1	3	6
	General Studies Advanced Elective	2	0	0	4
		8	3	12	25

* Project for the award of honours will be more advanced than that required for the award of the pass degree.

THIRD TERM

During the third term of the fourth year, students will devote additional time to the professional elective subjects and the preparation of their thesis.

Mining Engineering—Part-Time Course

Bachelor of Science (Technology)

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

The School of Mining Engineering offers at Broken Hill and Wollongong part-time courses in Mining Engineering leading to the degree of Bachelor of Science (Technology).

FIRST AND SECOND YEARS
(30 weeks' part-time course)
(Two subjects to be taken in each year)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.001 / 1.031	Physics I *or* Physics IAS	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	17

Third Year
(30 weeks' part-time course)

		Hours per week for three terms		
		Lec.	Tut./Lab.	Private Study
5.301	Engineering Mechanics	1	1	2
7.111/1	Mining Engineering I (Part 1)	1	0	1
8.253	Properties of Materials (Part 1)	2	1	3
10.022	Mathematics II (Parts 1 and 2)	3	1	4
		6½	3½	10

Fourth Year
(30 weeks' part-time course)

		Hours per week for three terms		
		Lec.	Tut./Lab.	Private Study
5.611	Fluid Mechanics/Thermodynamics	2	2½	4
7.111/2	Mining Engineering I (Part 2)	1½	1½	3
8.421	Engineering Surveying*	1	½	1½
25.001/1	Geology for Engineers†	1	1	2
	General Studies Elective	1	½	2
		6½	6	12½

* Including practical work.
† Two short Geology excursions are an essential part of the course.

Fifth Year
(30 weeks' part-time course)

		Hours per week for three terms		
		Lec.	Tut./Lab.	Private Study
6.801	Electrical Engineering	1	2	3
7.111/3	Mining Engineering I (Part 3)	1	2	3
7.121/1	Mine Surveying*	1	½	1½
7.551/1	Mining and Mineral Process Engineering (Part 2)†	1	0	1
25.102/1	Geology for Mining Engineers‡	2	2	3
	General Studies Elective	1	½	2
		7	7	13½

* Geology excursion will be conducted during the year.
† Course consists of 21 lectures and three visits, each of three hours, to Mineral Processing Plants.
‡ Including practical work.

SIXTH YEAR

(30 weeks' part-time course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
7.112/1	Mining Engineering II*	3	0	3	6
7.311/1	Mineral Processing I	1	0	2	3
7.113/1	Mineral Industry Elective Project†	0	1	1	4
	General Studies Elective	1	½	0	1
		5	1½	6	14

* 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.

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 second and third year vacations. The fourth year is common to all four Textile Technology courses.

Textile Technology—Full-Time Course
Bachelor of Science

First Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.031	Physics IAS*	3	1	2	3½
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
5.001	Engineering I	3	3	0	4½
10.011 / 10.001	Higher Mathematics I *or* Mathematics I	4	2	0	4
		12	6	6	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

Second Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.212	Physics IIT (Unit B)	½	0	1	2
2.002	Chemistry II	4	0	5	6
10.331	Statistics	1	1	0	1½
13.111	Textile Technology I	3	0	5	5
13.211	Textile Science I	2	1	0	4
	General Studies Elective	1	½	0	2
		11½	2½	11	20½

Third Year
(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.451	Chemistry II—Inorganic/Analytical	2	0	3	3½
13.112	Textile Technology II	6	0	7	10
13.212	Textile Science II	1	0	0	3
13.311	Textile Engineering I	1	0	0	1½
	Two General Studies Electives	2	1	0	4
		12	1	10	22

TEXTILE PHYSICS

SECOND YEAR

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.112	Physics II	4	0	3	4
10.111	Pure Mathematics II	3	2	0	4
10.331	Statistics	1	1	0	1½
13.111	Textile Technology I	3	0	5	5
13.211	Textile Science I	2	1	0	4
	General Studies Elective	1	½	0	2
		14	4½	8	20½

THIRD YEAR

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
1.213	Physics III	4	0	3	5
13.112	Textile Technology II	6	0	7	10
13.212	Textile Science II	1	0	0	2
13.311	Textile Engineering I	1	0	0	1½
	Two General Studies Electives	2	1	0	4
		14	1	10	22½

TEXTILE ENGINEERING

SECOND YEAR

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
5.301	Engineering Mechanics	1½	½	0	2
5.611/1	Fluid Mechanics*	1	0	1½	2
8.112	Materials and Structures	1	1	1	1½
10.031	Mathematics	1	1	0	2
10.331	Statistics	1	1	0	2
13.111	Textile Technology I	3	0	5	5
13.211	Textile Science I	2	2	0	4
	General Studies Elective	1	½	0	2
		11½	6	7½	20½

* Fluid Mechanics Section of 5.611 Fluid Mechanics/Thermodynamics.

THIRD YEAR

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
5.101/1	Mechanical Engineering Design	0	2	0	1
5.302	Theory of Machines	1½	1	0	2
6.801	Electrical Engineering	1	0	2	2
13.112	Textile Technology II	6	0	7	10
13.212	Textile Science II	1	0	0	2
13.311	Textile Engineering I	1	0	0	1½
	Two General Studies Electives	2	1	0	4
		12½	4	9	22½

TEXTILE MANUFACTURE

SECOND YEAR

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
10.331	Statistics	1	1	0	2
12.101	Psychology	2	1	0	2
13.111	Textile Technology I	3	0	5	5
13.211	Textile Science I	2	2	0	4
14.101	Accounting I	2	2	0	4
15.101	Economics I	2	1	0	3
	General Studies Elective	1	½	0	2
		13	7½	5	22

THIRD YEAR

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
12.501	Social Psychology	2	0	0	2
13.112	Textile Technology II	6	0	7	10
13.212	Textile Science II	1	0	0	2
13.311	Textile Engineering I	1	0	0	1½
14.321	Business Finance	2	0	0	3
28.101	Principles of Marketing	2	0	0	3
	General Studies Elective*	1	½	0	2
		15	½	7	23½

* Not to include Economics or Psychology.

Fourth Year

(30 weeks' day course)

Common to all four courses

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
13.113	Textile Technology III	5	0	3	8
13.213	Textile Science III	2	1	3	6
13.312	Textile Engineering II	1⅓	0	0	3
13.411	Project	0	0	7	2
	General Studies Advanced Elective	2	0	0	4
		10⅓	1	13	23

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 technology, 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 Technology, and there are further courses leading to the research degrees of Master of Science and Doctor of Philosophy.

The Wool Technology 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 men are familiar with the latest developments in fields relating to wool production, wool commerce, and wool utilization. They are also good practical wool men, capable of handling wool and recognizing its technical characteristics, through facility in subjective appraisal on which the whole wool trade is based. 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 and farm tours are arranged for senior students.

Requirements for Industrial Training

Each student is required to complete satisfactorily thirty-six weeks' practical work on approved sheep properties, twenty-four 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 required practical work, such application to contain a brief description of the property and to be in the hands of the Head of the School at the earliest possible date. Students should endeavour to obtain experience in the pastoral, sheep-wheat, and high rainfall sheep zones.

2. At the conclusion of the 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. The first interim report shall include a description of the property, including details of farm buildings, dip and yards, plant and equipment, stock numbers (in age and sex groups), and such features as water supplies, improved pastures, crops, etc. A sketch plan of the property should also be included.

(b) A final report to be submitted within a month of resumption of lectures. The final report should embody a report on a district basis in general and the property on which the student has worked in particular. The development of farming practices, the salient features of management in relation to the environment, pasturage, rainfall and distribution, water supplies, type of stock and breeding policies, statistics, etc., should receive consideration. The size and capacity of the farm buildings should be mentioned. Sketch plans with the principal measurements and photographs to illustrate features will be of value. Where applicable, details of pasture mixtures, rate of sowing for crops and fertiliser treatment should be recorded, as should also labour performances (both manual and with machines), and costs.

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

(iii) By students who carry out work for thirty-six 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.

Note.—Students will find that a loose-leaf note-book suitably indexed will be of great value for recording factual material, costs, material requirements for various jobs, et cetera.

Students are also encouraged to submit questions relating to any problems they may meet in the course of their practical work.

Wool Technology—Full-Time Course

Bachelor of Science

First Year

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
2.011 / 2.001	Higher Chemistry I *or* Chemistry I	2	0	4	5
10.011 / 10.001 / 10.021	Higher Mathematics I *or* Mathematics I *or* Mathematics IT	4	2	0	4
17.001	General and Human Biology	2	0	4	4
27.001	Geography	2	1	3	4
		10	3	11	17

Second Year

(30 weeks' day course)

		Hours per week for three terms			
		Lec.	Tut.	Lab.	Private Study
9.101	Livestock Production I	3	0	0	4½
9.221	Agronomy	2	0	2	4
9.531	Wool Technology I	2	0	4	4
10.331	Statistics	1	1	0	1½
41.111	Biochemistry	3	0	6	6
	General Studies Elective	1	½	0	4
		12	1½	12	24

THIRD YEAR

(30 weeks' day course)

		Hours per week											
		Term 1				Term 2				Term 3			
		Lec.	Tut.	Lab.	Private Study	Lec.	Tut.	Lab.	Private Study	Lec.	Tut.	Lab.	Private Study
9.122	Livestock Production II	3	0	0	4½	6	0	0	10½	3	0	0	6
9.311	Economics	2	0	0	4	2	0	0	4	1	0	0	2
9.411	Agricultural Chemistry	1	0	3	2	1	0	3	2	1	0	3	2
9.532	Wool Technology II	2	0	3	4	1	0	3	2	2	0	3	4
9.601	Animal Physiology I	2	0	3	3	1	0	3	1½	2	0	2	4
9.801	Genetics I	2	0	1	4	1	0	1	2	2	0	1	4
	Two General Studies Electives	2	1	0	4	2	1	0	4	2	1	0	4
		14	1	10	25½	14	1	10	26	13	1	9	26

FOURTH YEAR

(30 weeks' day course)

		Hours per week Term 1				Term 2				Term 3			
		Lec.	Tut.	Lab.	Private Study	Lec.	Tut.	Lab.	Private Study	Lec.	Tut.	Lab.	Private Study
9.001	Project	0	0	7*	0	0	0	7*	0	0	0	11*	0
9.123	Livestock Production III	1	1	0	2	1	1	0	2	2	0	0	4
9.231	Pastoral Agronomy	1	1	0	2	1	1	0	2	1	1	0	2
9.421	Animal Nutrition	2	0	0	4	2	0	0	4	0	0	0	0
9.533	Wool Technology III	0	0	1	0	0	0	1	0	0	0	1	0
	General Studies Advanced Elective	2	0	0	4	2	0	0	4	2	0	0	4
		6	2	8	12	6	2	8	12	5	1	12	10

Plus two of the following subjects, the choice to be approved by the Head of the School.

9.131	Ruminant Parasite Ecology	2	0	2	4	2	0	2	4	2	0	0	4
9.312	Farm Management	2	2	0	4	2	2	0	4	2	2	0	4
9.534	Wool Technology IV	2	0	2	4	2	0	2	4	2	0	2	4
9.901	Rural Extension	2	2	0	4	2	2	0	4	2	2	0	4
9.602	Animal Physiology II	2	0	2	4	2	0	2	4	2	0	2	4
41.102	Biochemistry	3	1	6*	6	3	1	6*	6	3	1	10*	6
9.802	Genetics II	2	0	2	4	2	0	2	4	2	0	2	4
9.811	Biostatistics	2	0	2	4	2	0	2	4	2	0	2	4

* Students electing the Biochemistry option must undertake an approved project in a related field.

Table of Pre-requisite and Co-requisite Subjects

Subject	*Pre-Requisite*	*Co-Requisite*
1st Year		
2.001 Chemistry	Nil	Nil
10.001 Mathematics	,,	,,
17.001 General and Human Biology	,,	,,
27.001 Geography I	,,	,,
2nd Year		
9.101 Livestock Production I	17.001 General and Human Biology	9.221 Agronomy 9.531 Wool Technology I 41.111 Biochemistry
9.221 Agronomy	2.001 Chemistry 17.001 General and Human Biology 27.001 Geography I	
9.531 Wool Technology I	17.001 General and Human Biology 2.001 Chemistry	9.101 Livestock Production I
3rd Year		
9.122 Livestock Production II	9.101 Livestock Production I	9.601 Animal Physiology 9.122 Livestock Production II
9.532 Wool Technology II	9.531 Wool Technology I 9.101 Livestock Production I	
9.601 Animal Physiology I	17.001 General and Human Biology 41.111 Biochemistry 2.001 Chemistry	9.122 Livestock Production II
9.801 Genetics I	17.001 General and Human Biology 10.331 Statistics 9.101 Livestock Production I	
9.411 Agricultural Chemistry 9.311 Economics	2.001 Chemistry 41.111 Biochemistry	
4th Year		
9.001 Project 9.123 Livestock Production III 9.231 Pastoral Agronomy 9.312 Farm Management 9.421 Animal Nutrition 41.102 Biochemistry 9.533 Wool Technology III 9.534 Wool Technology IV 9.602 Animal Physiology II 9.802 Genetics II 9.811 Biostatistics 9.901 Rural Extension	In general these subjects require the subjects of the 1st, 2nd and 3rd year or their equivalents.	Compulsory subjects of the 4th year gain by being taught as a group but could be taken singly, with the approval of Head of School. Optional subjects are to be approved by the Head of the School.

All students take common subjects up to and including third year. They have, therefore, all the pre-requisites for any two optional subjects they choose. There are no co-requisites for the two subjects chosen, all of which will have had a logical development during the first three years of the course.

POSTGRADUATE STUDY

The Faculty provides facilities for students to proceed to the higher degrees of Doctor of Philosophy, Master of Engineering, Master of Science and Master of Applied Science. Courses leading to the award of a Graduate Diploma are also offered. The degree of Doctor of Science is awarded for a contribution of distinguished merit in the fields of science, engineering or applied science.

The degrees of Doctor of Philosophy, Master of Engineering and Master of Science are all awarded for research and require the preparation and submission of a thesis embodying the results of an original investigation or design. Candidates for the Doctorate of Philosophy may read for the degree in this Faculty and are normally involved in three years' work. The work for the Master's degree may be completed in a minimum of one year, but normally requires two years of study.

The Faculty offers courses leading to the award of the degree of Master of Applied Science. The institution of this degree springs from the recognition of the considerable advance of knowledge in the fields of applied science and engineering which has marked recent years and the consequent increased scope for advanced formal instruction in these fields. Students are usually in attendance at the University for one year on a full-time basis, or for two years part-time.

Numbers of courses are also offered at the postgraduate level leading to the award of a Graduate Diploma. Students are required to attend courses of study for one year full-time or two years part-time. The courses available for the Graduate Diploma are Applied Geophysics, Corrosion Technology, Food Technology, Fuel Technology, Polymer Technology, Mineral Technology, Mining Engineering and Wool Technology.

Courses leading to the degree of Master of Applied Science and to Graduate Diplomas are available in Sydney only. Candidates may register for all the research degrees at Sydney. At Wollongong

University College and the W. S. and L. B. Robinson University College, Broken Hill, they may register for the degrees of Master of Science and Master of Engineering, subject to adequate research facilities and satisfactory supervision being available in the candidate's particular field of study. Where these special conditions can be met the Professorial Board may grant permission to a candidate to register for the degree of Doctor of Philosophy in these centres.

The conditions governing the award of the various higher degrees and graduate diplomas are set out in the Calendar.

Short, intensive graduate and special courses are provided throughout each year designed to keep practising scientists and technologists in touch with the latest developments in their various fields.

POSTGRADUATE ENROLMENT PROCEDURE

Courses Requiring Attendance at Formal Lectures

Students wishing to enrol in Master of Applied Science or Graduate Diploma courses must make application on the appropriate form to the Registrar at least two months 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.

Fees may be paid without penalty up to the end of the second week of term.

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 authorisation 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 First Term. (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 Term

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

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 First Term and for one month from the date on which a late fee becomes payable in Second and Third Term.

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 term, 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 Third Term.

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 term 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 $5

(ii) Graduation Fee $7

(iii) Course Fee — calculated on the basis of a term's attendance at the rate of $6 per hour per week. Thus the fee for a programme requiring an attendance of 24 hours per week for the term is 24 x $6 = $144 per term.

(iv) Thesis or Project Fee—$35 (an additional fee of $23* 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 $5

(ii) Award of Diploma Fee $7

(iii) Course Fee — calculated on the basis of a term's attendance at the rate of $6 per hour per week. Thus the fee for a programme requiring an attendance of 24 hours per week for the term is 24 x $6 = $144 per term.

(iv) Thesis or Project Fee—$35 (an additional fee of $23* 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 term's attendance at the rate of $6 per hour per week. Thus the fee for a subject requiring an attendance of 2 hours per week for the term is 2 x $6 = $12 per term.

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, $12.

University Union—entrance fee—$20.

Student Activities Fees—

University Union†—$12—annual subscription.

Sports Association†—$2—annual subscription.

Students' Union†—$5—annual subscription.

Miscellaneous—$10—annual fee.

* 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.

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

Examinations conducted under special circumstances —$7 for each subject.

Review of examination result—$7 for each subject.

Late Fees

First Term

Fees paid from commencement of third week of term to March 31 ..... $12

Fees paid after March 31 where accepted with the express approval of the Registrar (see above) $23

Second and Third Terms—

Fees paid in third and fourth weeks of term $12

Fees paid thereafter $23

Late lodgement of corrected enrolment details form (Late applications will be accepted for three weeks only after the prescribed dates.) $5

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 First Term 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 term has elapsed, one half of the term's fee may be refunded. Where a student terminates a course of study after half a term has elapsed, no refund may be made in respect of that term's fees.

The Library Fee is an annual fee and is not refundable where notice of withdrawal is given after the commencement of First Term. The University Union entrance fee is refundable only when notice of withdrawal is given before the commencement of First Term. On notice of withdrawal a partial refund of the Student Activities Fees is made on the following basis:

University Union—$2 in respect of each half term.

University of New South Wales Students' Union—where notice is given prior to the end of the fifth week of First term $2, thereafter no refund.

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

Miscellaneous—where notice is given prior to April 30 $5, 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	$12
(ii)	Registration Fee	$5
(iii)	Internal full-time student annual fee	$69
	Internal full-time student term fee	$23
(iv)	Internal part-time student annual fee	$36
	Internal part-time student term fee	$12
(v)	External student annual fee†	$23
(vi)	Final Examination (including Graduation Fee)	$35

(b) Doctor of Philosophy

(i)	Qualifying Examination	$12
(ii)	Registration Fee	$5
(iii)	Annual Fee	$69
(iv)	Final Examination (including Graduation Fee)	$48

(c) Doctor of Science

(i)	Registration Fee	$73

(d) Miscellaneous Subjects

Post-graduate 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 term's attendance at the rate of $6 per hour per week. Thus the fee for a subject requiring an attendance of 2 hours per week for the term is 2 x $6 = $12 per term.

* Candidates registered under the conditions governing the award of this degree without supervision will pay the following fees; Registration fee $5; Examination of thesis $69. 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.

Research

One day per week—$23 per annum.

Two or three days per week—$46 per annum.

Four or five days per week—$69 per annum.

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, $12.

University Union—$20—entrance fee.

Student Activities Fees—

University Union†—$12—annual subscription.

Sports Association†—$2—annual subscription.

Students' Union†—$5—annual subscription.

Miscellaneous—$10—annual fee.

LATE FEES

Initial Registration

Fees paid from commencement of sixth week after date of offer of registration to end of eighth week $12

Renewal at Commencement of each Academic Year

Fees paid from commencement of third week of term to March 31 .... $12

Fees paid after March 31 where accepted with the express approval of the Registrar $23

† 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 per annum for scholars without dependants to $2,800 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 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 $2,400, and is tenable for one to four years.

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.

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 recognised 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

From 1970 General Motors-Holden's Limited have 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. No new applications will be accepted in 1969, but current fellowship holders who are eligible to continue may make application for renewal in 1969.

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 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

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 13th 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., 314 Albert Street, East Melbourne, Victoria, 3002, by 15th 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. The awards are tenable for one to three years, and have a value ranging from $2,300 to $2,600, 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.

* Exempt University tuition fees.

Australian Meat Research Committee

The range of value of the awards is: Junior Studentships $1,000 to $1,400 p.a. (one year only). Senior studentships $2,500 to $2,800 p.a. (two years, with possible extension for a further year), plus fees and certain allowances for both junior and senior studentships. Applications to the Secretary, C.S.I.R.O., 314 Albert Street, East Melbourne, Vic., 3002, by 4th November.

Conzinc Riotinto of Australia Limited

The award is given for post-graduate study and research in the fields of Mining, Chemical Engineering, Geology or Metallurgy. The value of the award is $2,000 p.a. plus University fees for one to three years. Applications should be lodged with Conzinc Riotinto of Aust. Ltd., Box 384D, Melbourne, Victoria, 3001, by 1st December.

Zinc Corporation Ltd. and New Broken Hill Consolidated Ltd.

The award is given for post-graduate study and research in the fields of Mining, Metallurgy and allied fields. Its value is $1,200 p.a., plus University fees for a two-year period. (Preference given to Broken Hill residents.) Applications should be lodged with the Zinc Corporation Ltd., P.O. Box 444, Broken Hill, N.S.W., 2880.

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 the fields of Science, Applied Science and Engineering. Candidates are expected to have graduated with first or second class honours. The salary per annum is: first year $3,639; second year $3,948; third year $4,298; fourth year $4,682. Compulsory fees are paid by the Department. Candidates holding a Master's Degree will commence on the second year rate. A bond of service is required. Applications will close towards the end of November and should be sent to the Secretary, Department of Supply, Constitution Avenue, Parkes, A.C.T., 2600.

Wheat Industry Research Council Award

The range of value of the award is: Junior Studentships—$1,000 to $1,400 p.a. University fees and allowances for one year; Senior Studentships—$2,500 to $2,800 p.a. and University fees for two years. An application for a third year to complete the degree of Doctor of Philosophy will be considered. Applications should be lodged with the Secretary, Wheat Industry Research Council C/- Department of Primary Industry, Canberra, A.C.T., 2600, by 25th October.

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 Pollution Control Engineering. Graduate Diploma courses are offered: in Applied Geophysics by the Schools of Applied Geology and Geography combined; 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.

SCHOOL OF APPLIED GEOLOGY

Hydrogeology Graduate Course (Master of Applied Science)

The purpose in instituting this postgraduate 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.

30 Weeks' Course

		Hours per week for three terms		
		Lec.	Lab.	Private 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	—	9	10
27.901G	Geomorphology for Hydrologists	1	2	2
		7	17	24

Applied Geophysics Graduate Course (Graduate Diploma)

The Schools of Applied Geology and of Geography combine to offer this course. Its aim 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.

30 Weeks' Course

		Hours per week for three terms	
		Lec./Lab.	Private Study
6.168G	Potential and Systems Theory in Geophysics	2	4
6.841	Electronic Instrumentation	2	4
8.421S	Surveying*	3	3
10.351	Statistics†	1½	2
25.111G	Geology	4	3
25.321G	Geophysics	6	12
		18½	28

* A survey camp of one week in third term is part of this course.
† Students who have satisfactorily completed a statistics course equivalent to 10.351 may elect to take the statistics component of 10.061G in the Master of Engineering Science course in Electrical Engineering.

SCHOOL OF CHEMICAL ENGINEERING

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.

		Hours per week for three terms	
		Lec./Lab.	Private Study
3.173G	Physical Transport Processes	2	4
3.174G	Thermodynamics and Theory of Rate Processes	1	2
3.175G	Bioprocess Dynamics and Plant Design	3	3
3.176G	Continuous Culture Processes	1	2
42.201G	Theoretical Biology	1	2
42.202G	Microbiology and Biochemistry	8	12
		16	25

3.900G Project

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.

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.

		Hours per week for three terms	
		Lec./Lab.	Private Study
3.191G	Chemical Reactor Engineering I	3	6
3.192G	Chemical Reactor Engineering II	2	4
3.193G	Industrial Process Kinetics	2	4
3.194G	Kinetic Models and Parametric Studies	2	4
3.195G	Specialist Lectures	1	2
	* Graduate Electives	2	4
		12	24

3.900G Projects

The results of the project must be submitted in accordance with University requirements for Master of Applied Science thesis.

		Hours per week	
		Lec./Lab.	Private Study
3.161G	Corrosion Technology I	2	4
3.162G	Corrosion Technology II	2	4
3.181G	Heat Mass and Momentum Transfer	2	4
3.182G	Thermodynamics of Biological Systems	1	2
3.183G	Chemical Plan, Design and Operation	5	7
3.196G	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

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

* Student may select one subject from the following list.

Pollution Control Engineering Graduate Course (Master of Applied Science)

The graduate course in Pollution Control Engineering 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 if the appropriate pre-requisites are taken. 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.

		Hours per week for three terms	
		Lec./Lab.	Private Study
3.163G	Ground and Surface Waters Treatment and Re-use	1	2
3.164G	Plant and Process Design	2	4
3.165G	Process Optimization	1	2
3.166G	Trade Waste Disposal	1	2
3.193G	Industrial Process Kinetics	2	4
3.194G	Kinetic Models and Parametric Studies	2	4
3.242G	Treatment of Biological Effluents	2	4
3.391G	Atmospheric Pollution and Control	2	2
44.111	Microbiology	3	2
		16	26

3.900G 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 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.

Corrosion Technology Graduate Course (Graduate Diploma)

The Graduate Diploma course in Corrosion Technology has been designed as a post-graduate course for graduates in Engineering, Applied Science and Science, who may be faced with corrosion problems in industry.

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.).

FIRST YEAR

(30 weeks' part-time course)

		Hours per week for three terms	
		Lec./Lab.	Private Study
Introductory Stage			
3.161G	Corrosion Technology I	1	2
3.171G	Corrosion Literature Assignment	2	4
4.111G	Corrosion Metallurgy I	1	2
	In addition, candidates not sufficiently qualified may be required to complete one of the following subjects:		
2.002	Chemistry IIS	9	7
4.911	Materials for Engineers	2	4

SECOND YEAR

(30 weeks' part-time course)

		Hours per week for three terms	
		Lec./Lab.	Private Study
Advanced Stage			
3.162G	Corrosion Technology II	2	4
3.172G	Corrosion Assignments	2	4
4.112G	Corrosion Metallurgy	2	4
22.351G	Organic Surface Coatings	2	4
		8	16

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:

30 Weeks' Course

		Hours per week for three terms Lec./Lab./ Tut.	Private Study
2.271G	Chemistry and Analysis of Foods	3	3
3.231	Chemical Engineering	2	4
3.241G	Food Technology	4	7
42.201G	Biology	1	1
42.202G	Biochemistry and Microbiology	8	10
		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:

30 Weeks' Course

		Hours per week for three terms	
		Lec./Lab.	Private 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, e.g., Coal Preparation, Instrumention 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.

First Year

(30 weeks' part-time course)

	Term 1 Hours per week Lec.	Lab.	Priv. /Tut.	Study	Term 2 Hours per week Lec.	Lab.	Priv. /Tut.	Study	Term 3 Hours per week Lec.	Lab.	Priv. /Tut.	Study
22.321G Polymer Engineering I												
(a) Polymer Compound Design	2	5	4		0	0	0		0	0	0	
(b) Polymer Processing	0	0	0		2	5	4		0	0	0	
(c) Physical Testing I	0	0	0		0	0	0		2	0	4	
22.331G Polymer Chemistry I												
(a) Processes	2	0	4		0	0	0		0	0	0	
(b) Mechanisms and Kinetics	0	0	0		2	0	4		0	0	0	
(c) Polymer Analysis	0	0	0		0	0	0		2	0	4	
(d) Laboratory	0	0	0		0	0	0		0	5	0	
	4	5	8		4	5	8		4	5	8	

Second Year

(30 weeks' part-time course)

	Term 1 Hours per week Lec.	Lab.	Priv. /Tut.	Study	Term 2 Hours per week Lec.	Lab.	Priv. /Tut.	Study	Term 3 Hours per week Lec.	Lab.	Priv. /Tut.	Study
22.322G Polymer Engineering II												
(a) Polymer Physical Properties	2	0	4		0	0	0		0	0	0	
(b) Engineering Application of Polymers	0	0	0		2	0	4		0	0	0	
(c) Physical Testing II	0	0	0		0	0	0		2	5	4	
22.332G Polymer Chemistry II												
(a) Polymer Structure and Characterisation	2	0	4		0	0	0		0	0	0	
(b) Natural Polymers	0	0	0		2	0	4		0	0	0	
(c) Inorganic Polymers	0	0	0		0	0	0		2	0	4	
(d) Laboratory	0	5	0		0	5	0		0	0	0	
	4	5	8		4	5	8		4	5	8	

SCHOOL OF METALLURGY

The School of Metallurgy will offer a graduate course in Welding Technology in 1969, and plans to introduce courses in Foundry Technology and Metal Processing at a later date. Details regarding these proposed courses, which are intended primarily for graduates in metallurgy and engineering, and which may lead to the award of the degree of Master of Applied Science, are available from the Head of the School.

The School also runs short courses on topics in Chemical and Extractive Metallurgy and Physical Metallurgy from time to time.

In addition to these opportunities for formal post-graduate studies, graduates in Metallurgy, Science or Engineering who are interested in doing research in the field of metallurgy may apply for registration as candidates for the degrees of Master of Science or Doctor of Philosophy.

The Head of the School will be pleased to give information about research scholarships, fellowships and grants-in-aid. Graduates are advised to consult him before making a formal application for registration.

SCHOOL OF MINING ENGINEERING

The School offers two 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.

30 Weeks' Course

		Hours per week for three terms	
		Lec./Lab.	Private Study
STAGE A. *Introductory stage*			
7.311	Mineral Processing I	6	6
25.201	Mineralogy	2	2
		8	8
STAGE B. *Advanced stage*			
7.391G	Mineral Processing Technology	3	6
7.392G	Mineral Engineering—Laboratory	4	4
		7	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.

30 Weeks' Course

		Hours per week for all terms	
		Lec./Lab.	Private Study
STAGE A. *Introductory stage*			
7.121S	Mine Surveying	2	3
7.191G	Mining Engineering	2	3
7.551S	Mining and Mineral Process Engineering*	4	3
		8	9
STAGE B. *Advanced stage*			
7.192G	Mining Engineering Technology	4	6
7.193G	Mining Engineering Laboratory	3	3
		7	9

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

SCHOOL OF WOOL AND PASTORAL SCIENCES

Wool Technology Graduate Course (Graduate Diploma)

The Graduate Diploma Course in Wool Technology is specially designed for graduate students preparing themselves for careers in the pastoral industry. One of the principal functions of the course is to provide a bridge from other disciplines such as Agriculture, Veterinary Science and Pure Science, for graduates who wish to study and work in the field of Wool and Pastoral Sciences 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.

* This course extends over 21 weeks only.

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

(30 weeks' course)

		Hours per week for three terms		
		Lec.	Lab.	Private 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.).

DESCRIPTION OF SUBJECTS

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.

TEXT BOOKS

Dana's Minerals and How to Study Them. 1963 Third Science Ed. Revised by C. S. Hurlbut, Jr.

Longwell and Flint. *Introduction to Physical Geology.* Wiley.

McElroy. *Explanatory Notes to accompany the Sydney 4-mile Geological Map* (with map). Bureau of Mineral Resources, Canberra.

Read. *Rutley's Elements of Mineralogy.* Murby, London.

REFERENCE BOOKS

Dunbar. *Historical Geology.* Wiley.

Ford. *Dana's Textbook of Mineralogy.* Wiley.

Holmes. *Principles of Physical Geology.* Revised ed. Nelson & Sons, London, 1965.

Morley Davies. *An Introduction to Palaeontology.*

25.002 Geology II

Crystallography and Mineralogy—Morphological and physical crystallography; the stereographic projection, its properties and use in crystallography. Introduction to the crystalline state and the use of X-ray methods in crystallography. The atomic arrangements in crystals. Elements of optical crystallography. Descriptive mineralogy of ores and minerals. Study of the

major rock-forming mineral families based on the principles of crystal chemistry. *Practical work:* Recognition of crystal forms. Exercises in stereographic projection. Interpretation of a simple X-ray diffraction photograph. Recognition and description of ores and minerals in hand specimen. Simple determinations of optical properties of mineral fragments. Examination of orientated crystal plates in convergent light.

Petrology—Principles and theories relating to the occurrence, genesis and diversification of igneous rocks. Introduction to sedimentary and metamorphic rocks. *Practical Work:* Megascopic and microscopic examination of selected rocks. *Field Work:* One field trip of approximately one week and at least one other shorter field tutorial to illustrate the above course will be held during the year. Attendance at these field instruction tutorials is compulsory.

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—Geological mapping. The stratigraphic column. Principles of stratigraphy, including related structural aspects. Sedimentary environments, processes and products. The stratigraphy of selected geological provinces in Australia. *Field work:* to illustrate the above course will be held during the year, attendance at which is compulsory. This includes one field tutorial of approximately one week and at least one short field tutorial.

Petrology I
TEXT BOOKS
Kerr. *Optical Mineralogy*. McGraw-Hill, 1959.
Williams, Turner and Gilbert. *Petrography*, Freeman, 1954.

REFERENCE BOOKS
Harker. *Metamorphism.*
Harker. *Petrology for Students.*
Hatch, Wells and Wells. *The Petrology of the Igneous Rocks.*
Turner and Verhoogen. *Igneous and Metamorphic Petrology.*
Tyrrell. *The Principles of Petrology.*
Wahlstrom. *Theoretical Igneous Petrology*. Wiley.

Palaeontology I
TEXT BOOKS
Beebower. *Search for the Past*. Prentice-Hall, 1960, or
Moore, Lalicker and Fischer. *Invertebrate Fossils*. McGraw-Hill, 1952.

REFERENCE BOOKS
Arnold. *An Introduction to Palaeobotany*. McGraw-Hill, 1947.
Schrock and Twenhofel. *Principles of Invertebrate Palaeontology*. McGraw-Hill.
Woods. *Palaeontology Invertebrate*. Cambridge University Press.

Stratigraphy I
TEXT BOOK
Krumbein and Sloss. *Stratigraphy and Sedimentation*. 2nd ed.

REFERENCE BOOKS
David, ed., Browne. *Geology of the Commonwealth of Australia*. 3 vols. Arnold, 1950.
Schrock. *Sequence in Layered Rocks.*
Woodford. *Historical Geology*. Freeman, 1965.

Mineralogy
TEXT BOOKS
Hurlbut, edited by. *Dana's Manual of Mineralogy.*
Phillips. *An Introduction to Crystallography.*
REFERENCE BOOKS
Wahlstrom. *Optical Crystallography.* 3rd ed.

25.003/1, 25.003/2 and 25.003/3 Geology III Parts I, II and III

Part I

Stratigraphy—Regional stratigraphy with emphasis on environmental aspects. Evolution of selected basins and geosynclines. Studies of systems in type areas. The facies concept. Mapping procedures and stratigraphic maps.

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.

Palaeontology—Applications of palaeontology to stratigraphy (geochronology and palaeoecology). Vertebrate palaeontology.

Part II

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:* Micropetrography. Techniques of sedimentary petrology.

Part III

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.

Mineral Deposits—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.

Fuels—Nature and origin of coal and coal seams and of petroleum and petroliferous strata. Coal petrography. Techniques of petroleum geology. *Field work* will be carried out during the year. This includes a geological survey camp which may be held before first term, at least one tutorial of approximately one week, and such short trips as may be arranged. Attendance is compulsory.

Petrology II
TEXT BOOKS
Kerr. *Optical Mineralogy*. McGraw-Hill, 1959.
REFERENCE BOOKS
Harker. *Metamorphism*. Methuen.
Turner and Verhoogen. *Igneous and Metamorphic Petrology*.

Stratigraphy II
REFERENCE BOOKS
Gignoux. *Stratigraphic Geology* (English Translation).
Kuenen. *Marine Geology*.
David ed., Browne. *Geology of the Commonwealth of Australia*. 3 vols., 1950.
Dunbar and Rodgers. *Principles of Stratigraphy*. Wiley, 1957.

Stratigraphical Palaeontology
TEXT BOOKS
Colbert. *Evolution of the Vertebrates*.
Von Koenigswald. *The Evolution of Man*.

Mineralogy
REFERENCE BOOKS
Azaroff and Buerger. *The Powder Method*. McGraw-Hill.
Buerger. *X-ray Crystallography*. Wiley.
Bunn. *Chemical Crystallography*. Oxford.
Evans. *Crystal Chemistry*. Cambridge.
Henry, Lipson and Wooster. *The Interpretation of X-ray Diffraction Photographs*. Macmillan.
Wahlstrom. *Optical Crystallography*. 3rd ed, Wiley.

Geophysics
TEXT BOOK
Howell. *Introduction to Geophysics*. McGraw-Hill, 1959.
REFERENCE BOOKS
Bullen. *Introduction to Theory of Seismology*. Cambridge, 1963.
Chapman. *The Earth's Magnetism*. Methuen, 1951.
Garland. *The Earth's Shape and Gravity*. Pergamon, 1964.
Gutenberg. *Physics of the Earth's Interior*. Academic, 1959.
Heiskanen and Vening Meinesz. *The Earth and its Gravity Field*.
Hill. *The Sea*, Vol. 3. Wiley, 1963.
Irving. *Palaeomagnetism*. Wiley, 1964.
Jacobs. *The Earth's Core and Geomagnetism*. Pergamon, 1963.

Structural Geology
TEXT BOOKS
Hills. *Outlines of Structural Geology*. 3rd ed., 1953.
Phillips. *Use of Stereographic Projection in Structural Geology*. 1954.
REFERENCE BOOKS
Billings. *Structural Geology*. 1954.
De Sitter. *Structural Geology*. 1956.
Hills. *Elements of Structural Geology*. 1963.
Turner. *Mineralogical and Structural Evolution of the Metamorphic Rocks*. Mem. No. 30 Geol. Soc. America, 1948.
Turner and Weiss. *Structural Analysis of Metamorphic Tectonics*. McGraw-Hill, 1963.

Economic Geology
(i) *COAL*
TEXT BOOK
Raistrick and Marshall. *The Nature and Origin of Coal and Coal Seams*, 1952.

REFERENCE BOOK
Francis. *Coal, Its Formation and Composition.*

(ii) *OIL*
TEXT BOOK
Levorsen. *Petroleum Geology.* 1954.

REFERENCE BOOK
LeRoy. *Subsurface Geologic Methods.*

(iii) *ORE DEPOSITS*
REFERENCE BOOKS
Edwards. *Textures of the Ore Minerals.* 2nd ed., 1954.
Fiftieth Anniversary Volume of Economic Geology. Vols. I and II, Society of Economic Geologists, Urbana, Illinois.
Geology of Australian Ore Deposits. 2nd ed., Melbourne, 1965. Aust. Inst. Min. and Met.
Lindgren. *Mineral Deposits.* 4th ed., 1933.

25.004/1, 25.004/2, 25.004/3 and 25.004/4 Geology IV Parts I, II, III and IV

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.

Photogeology—An introduction to the principles of photogrammetry and photointerpretation. Methods of photogeological mapping using stereoscopes and stereoplotters. The recognition of geological features on air photos. Laboratory work consists of exercises in the use of stereoscopes, the study of air photographs illustrating typical geological features, and the production of photogeological maps using mirror stereoscopes.

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.*

Students in the Faculty of Applied Science will be required to carry out some additional laboratory assignments.

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 Project

Mining Geology
TEXT BOOK
Lawrence (edited by). *Exploration and Mining Geology.* Melbourne, 1965. Aust. Inst. Min. Met.

REFERENCE BOOK
McKinstry. *Mining Geology.* Prentice Hall.

Photogeology
REFERENCE BOOKS
Krynine and Judd. *Principles of Engineering Geology and Geotechnics.* McGraw-Hill, 1957.
Leuder. *Aerial Photo Interpretation.* McGraw-Hill, 1959.
Manual of Photographic Interpretation. Am. Soc. of Photogrammetry, Washington, 1960.

Geophysics
TEXT BOOKS
Dobrin. *Introduction to Geophysical Prospecting.* McGraw-Hill, 1960.
Parasnis. *Principles of Applied Geophysics.* Methuen, 1962.

REFERENCE BOOKS
Dix. *Seismic Prospecting for Oil.* Harper, 1952.
Edge and Laby. *The Principles and Practice of Geophysical Prospecting.* Cambridge, 1931.
Grant and West. *Interpretation Theory in Applied Geophysics.* McGraw-Hill, 1964.
Heiland. *Geophysical Exploration.* Prentice Hall, 1940.
Jakosky. *Exploration Geophysics.* Trija, 1950.
Pirson. *Handbook of Well Log Analysis.* Prentice-Hall, 1963.

Engineering Geology
See list for Geology for Engineers (25.101).

Petroleum Engineering
REFERENCE BOOK
Uren. *Petroleum Production Engineering Development.*

25.013 Geology III (Supplementary)

For Science students. Consists of section (*a*) and two components of section (*b*) approved by the Head of School.

Section (a)

Geology of Fuels—Ten advanced lectures on the geology of coalfields and the petrology and mineralogy of coal. Ten advanced lectures on the geology of oil and oilfields including natural gas. *Practical:* Lithological, petrological and mineragraphic examination of various coals.

Geomorphology and Photogeology—The principles of geomorphology and landscape development. The geomorphology of New South Wales. Principles of photogeology and of photo-interpretation. *Practical:* Geomorphological and photogeological exercises will be carried out in the laboratory and the field.

Structural Geology—Structural analysis of metamorphic tectonites. Construction of block diagrams based on the orthographic projection.

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.

Geochemistry—Principles of geochemical distribution of elements. The geochemical cycle. Mineral thermodynamics and phase equilibria. Oxidation and reduction potentials. Isotope geology. Meteorites.

Exploration Geophysics—The theory, interpretation and practice of geophysical methods in exploration: Seismic, electric, electromagnetic, gravity, magnetic, radioactive and well logging. Applications in hydrology, engineering, petroleum and mining geophysics. Laboratory requirements include conducting model experiments illustrating the different methods. Field requirements include five days spent in field tutorials on the practice of geophysical methods.

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.

Clay Mineralogy—The structures and properties of the clay mineral groups. Techniques for their recognition. Clay-water systems and ion exchange. Some applied aspects of clay mineralogy. Laboratory work to illustrate the lecture course.

Stratigraphy—Selected stratigraphy topics with emphasis on basin analysis. Detailed treatment of sedimentary structures. Advanced study of stratigraphic maps. Specialized aspects of photogeology and map interpretation.

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.

Oceanography
TEXT BOOK
Pickard. *Descriptive Physical Oceanography*. Pergamon, 1964.

REFERENCE BOOKS
King. *Introduction to Oceanography*. McGraw-Hill.
Kuenen. *Marine Geology*. Wiley.

Palaeontology II
TEXT BOOK
Glaessner. *Principles of Micro-palaeontology*. Melbourne University Press, 1945. Hafner reprint ed., 1963.

REFERENCE BOOKS
Beerbower. *Search for the Past*. Prentice Hall, 1960.
Cushman. *Foraminifera*. Harvard University Press, 1950.
Mayr, Linsley and Usinger. *Methods and Principles of Systematic Zoology*. McGraw-Hill.
Simpson. *Principles of Animal Taxonomy*. Columbia University Press, 1961.

Stratigraphy III
REFERENCE BOOKS
See list for Stratigraphy II (25.003).

Structural Geology II
TEXT BOOK
De Sitter. *Structural Geology*. 1956.

REFERENCE BOOK
As for Structural Geology I (25.003).

Geophysics II
TEXT AND REFERENCE BOOKS
As for Geophysics II in Geology IV (25.004).

Geochemistry
TEXT BOOK
Mason. *Principles of Geochemistry.* 2nd ed.

REFERENCE BOOK
Abelson. *Researches in Geochemistry.*
Goldschmidt. *Geochemistry.*
Rankama and Sahama. *Geochemistry.* 1950.
Smales and Wager. *Methods in Geochemistry.* 1960.

Mineragraphy
TEXT BOOKS
Edwards. *Textures of the Ore Minerals.* 2nd ed., 1954.
Hallimond. *1953 Manual of the Polarizing Microscope.*

REFERENCE BOOKS
Cameron. *Ore Microscopy.* 1961.
Ramdohr. *Die Erzmineralien und ihre Verwachsungen.* 3rd ed., 1960.

Clay Mineralogy
REFERENCE BOOKS
Grim. *Clay Mineralogy.* 1953.
Grim. *Applied Clay Mineralogy.* 1962.

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.

TEXT BOOK
Blyth. *Geology for Engineers.* 4th ed. 1960.

REFERENCE BOOKS
Application of Geology to Engineering Practice. Geol. Soc. of America, N.Y., 1950.
Dapples. *Basic Geology.* Wiley, 1959.
Krynine and Judd. *Principles of Engineering Geology and Geotechnics.* McGraw-Hill, 1957.
Schultz and Cleaves. *Geology in Engineering.* Wiley, 1952.

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.

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.

TEXT BOOKS

Lawrence (edited by). *Exploration and Mining Geology*. Melbourne, 1965. Aust. Inst. Min. Met.

Parasnis. *Principles of Applied Geophysics*. Methuen, 1962.

REFERENCE BOOK

Dobrin. *Introduction to Geophysical Prospecting*. McGraw-Hill, 1960.

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.

TEXT BOOK
Dana. *Manual of Mineralogy*, or
Read. *Rutley's Elements of Mineralogy*.

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.

REFERENCE BOOKS
Blyth. *Geology for Engineers*, 4th ed., 1960.
Kerr. *Optical Mineralogy*. McGraw-Hill, 1959.
Krumbein and Sloss. *Stratigraphy and Sedimentation*, 2nd ed.
Hills. *Outlines of Structural Geology*, 3rd ed., 1953.
Miller. *Photogeology*. McGraw-Hill, 1961.
Williams, Turner and Gilbert. *Petrography*. Freeman, 1954.

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 of field tutorials on the practice of geophysical methods.

TEXT BOOKS
Dobrin. *Introduction to Geophysical Prospecting*. McGraw-Hill, 1960.
Grant and West. *Interpretation Theory in Applied Geophysics*. McGraw-Hill, 1965.
Howell. *Introduction to Geophysics*. McGraw-Hill, 1959.
Parasnis. *Principles of Applied Geophysics*. Methuen, 1962.

REFERENCE BOOKS
Bullen. *Introduction to Theory of Seismology*. Cambridge, 1963.
Chapman. *The Earth's Magnetism*. Methuen, 1951.
Dix. *Seismic Prospecting for Oil*. Harper, 1952.
Electrical Prospecting with Telluric Current Method. Vol. 57, No. 2, 1962. Colorado School of Mines.
Ewing, Jardetsky and Press. *Elastic Waves in Layered Media*. McGraw-Hill, 1957.
Garland. *The Earth's Shape and Gravity*. Pergamon, 1965.
Geophysics Well Logging. Vol. 60, No. 1, 1965. Colorado School of Mines.
Heiland. *Geophysical Exploration*. Hafner, 1963.

Heiskanen and Vening Meinesz. *The Earth and its Gravity Field.* McGraw-Hill, 1958.
Hill. *The Sea,* Vol. 3. Wiley, 1963.
Irving. *Palaeomagnetism.* Wiley, 1964.
Jakosky. *Exploration Geophysics.* Trija, 1956.
Malmstadt, Enke and Taren. *Electronics for Scientists.*
Moon and Spencer. *Field Theory: Field Theory for Engineers.* Van Nostrand, N. J., 1961.
Pirson. *Handbook of Well Log Analysis.*
Tagg. *Earth Resistances.* George Newness, 1964.
White. *Seismic Waves.* McGraw-Hill, 1965.
Wyllie. *The Fundamentals of Electric Log Interpretation.* Academic, 1957.

25.401G Ground Water Investigations

Groundwater Geophysics, geophysics applied to groundwater exploration and assessment, geophysical methods utilised in well-logging. The role of structural and physical geology in groundwater studies, groundwater problems in semi-arid and arid zones. Geochemistry of groundwater, the use of tracers in groundwater studies, hydrogeologic maps and their interpretation, evaluation of groundwater in the hydrologic cycle, introduction to the exploration and development of groundwater. Drilling equipment, well development and testing. Practical work will include the analysis of groundwater samples, field studies of geological and geophysical methods applied to groundwater. Field tutorials in experimental catchments will be also held.

TEXT BOOK
Davis and De Wiest. *Hydrogeology.* Wiley, 1966.

REFERENCE BOOKS
Heath and Trainer. *Introduction to Groundwater Hydrology.* Wiley, 1968.
Thomas. *The Conservation of Groundwater.* McGraw-Hill, 1951.
Todd. *Groundwater Hydrology.* Wiley, 1959.

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.

TEXT BOOK
Davis and De Wiest. *Hydrogeology.* Wiley, 1966.

REFERENCE BOOKS
Miller. *Photogeology.* McGraw-Hill, 1961.
Todd. *Groundwater Hydrology.* Wiley, 1959.
Ward. *Principles of Hydrology.* McGraw-Hill, 1967.

25.403G Project (Hydrogeology Graduate Course)

25.411G Engineering Geology

Structural geology, primary and secondary structures in rocks, introduction to petrofabrics, the role of structural geology in rock mechanics. Petrology, an introduction to micro-petrology and the petrology of the main rock types, petrology applied to engineering. Clay Mineralogy, clay

minerals and their properties, differential thermal analysis and X-ray diffraction techniques, application of clay mineralogy to engineering and hydrologic problems. Engineering geophysics. Photo-geological interpretation. Further studies in geological science with engineering applications. Practical work to cover the use of the petrological microscope, exercises in the analysis of rock structures and geological mapping. Field tutorials will be included.

SCHOOL OF CHEMICAL ENGINEERING

DEPARTMENT OF CHEMICAL ENGINEERING

3.111 Chemical Engineering I

Principles I: The principles of heat transfer and fluid statics and dynamics, together with a simple introduction to boundary layer theory and heat and momentum transfer analogies.

Calculations: Will be conducted mainly by tutorials supplemented by lectures where necessary. Students will attempt 30-40 problems throughout the year. In Third Term students will be required to solve a large integrated problem.

3.111/1 Chemical Engineering I (Principles)

Principles I as set out in 3.111 Chemical Engineering I.

TEXT BOOK *Principles*

Coulson and Richardson. *Chemical Engineering.* Vol. I. Pergamon. *or*

Foust, Wenzel, Clump, Maus and Andersen. *Principles of Unit Operations.* Wiley.

Perry. *Chemical Engineers' Handbook.* McGraw-Hill.

REFERENCE BOOKS

Badger and Banchero. *Introduction to Chemical Engineering.* McGraw-Hill.

Eckert and Drake. *Heat and Mass Transfer.*

Knudson and Katz. *Fluid Dynamics and Heat Transfer.*

Kreith. *Principles of Heat Transfer.* International Text Book.

McCabe and Smith. *Unit Operations of Chemical Engineering.* McGraw-Hill.

TEXT BOOK *Calculations*

Himmelblau. *Basic Principles and Calculations in Chemical Engineering.* Prentice Hall.

REFERENCE BOOKS

Allcock and Jones. *The Nomogram.* Pitman.

Corcoran and Lacey. *Introduction to Chemical Engineering Problems.*

Davies. *Statistical Methods in Research and Production.*

Haslam and Russell. *Fuels and their Combustion.* McGraw-Hill.

Hougen, Watson and Ragatz. *Chemical Process Principles.* Vol. 1. Wiley.

Johnson. *Nomography and Empirical Equations.*

Johnstone and Thring. *Pilot Plant Models and Scale-up Methods in Chemical Engineering.* McGraw-Hill.

Langhaar. *Dimensional Analysis and the Theory of Models.*

Lewis, Radasch and Lewis. *Industrial Stoichiometry.* McGraw-Hill.

Lipka. *Graphical and Mechanical Computations.*

Mickley, Sherwood and Reed. *Applied Mathematics in Chemical Engineering.* McGraw-Hill.

Schmidt and List. *Material and Energy Balances.* Prentice Hall.

Worthing and Geffner. *Treatment of Experimental Data.*

3.121 Chemical Engineering IIA

Thermodynamics—Introduction to chemical engineering thermodynamics. *Kinetics*—Order of reaction and methods of determination. Theory of rate processes. Introduction to reactor design. *Management and Data Processing*—Methods engineering, data processing, administration, development, marketing, and industrial and commercial law.

Thermodynamics and Kinetics

TEXT BOOKS

Levenspeil. *Chemical Reaction Engineering.* Wiley.
Smith and Van Ness. *Introduction to Chemical Engineering Thermodynamics.* McGraw-Hill.

REFERENCE BOOKS

Boudart. *Kinetics of Chemical Process.* Prentice-Hall.
Denbigh. *Principles of Chemical Equilibrium.* Cambridge.
Dodge. *Chemical Engineering Thermodynamics.* McGraw-Hill.
Frost and Pearson. *Kinetics and Mechansim.* Wiley.
Guggenheim. *Thermodynamics.*
Hougen, Watson and Ragatz. *Chemical Engineering Principles.* Vol. 2. Wiley.
Robinson. *Mathematical Preparation for Physical Chemistry.* McGraw-Hill.
Smith. *Chemical Engineering Kinetics.* McGraw-Hill.
Walas. *Chemical Engineering Kinetics.* McGraw-Hill.
Weber and Meissner. *Thermodynamics for Chemical Engineers.*

Management and Data Processing

TEXT BOOKS

Blatt. *Introduction to Fortran IV Programming.* Prentice-Hall.
Peterson, G. R. *Basic Analog Computation.* Collier Macmillan, 1967.
Sykes, Edward. *The Employer, Employee and the Law.* Law Book Co.
Yorston and Fortescue. *Australian Mercantile Law.* 11th ed.

REFERENCE BOOK

Germaine, Clarence. *Programming for the 1620.* 2nd ed. Prentice Hall.

3.122 Chemical Engineering IIB

Principles II

Stage Operations: Mass transfer operations, descriptions of equipment for stage operations, phase equilibria.

Molecular and Turbulent Transport: Molecular diffusion, thermal diffusion, momentum transport, film, boundary layer and penetration theories, non-Newtonian fluids, transport properties of liquid gases and solids, steady state transfer between phases, turbulent transport, empirical correlations, analogies, applications to transfer between gases, liquids and solids, equipment for mass transfer use of the transfer unit, solution of isothermal and adiabatic problems in distillation absorption, extraction and adsorption, prediction of stage efficiencies.

Heat Transfer: Unsteady state, extended surfaces, condensing and boiling. More advanced treatment of conduction, convection and radiation. Network method, jacketed vessels, simultaneous heat and mass transfer, analogies and limitations.

Solids Handling: Particle size distribution functions, sieve analysis, energy size relationships in comminution, separation of particulate material by froth flotation and electrical methods (course provided by the School of Mining Engineering).

Solid-Fluid Systems (2-phase systems): Flow of particles through fluids, flow of fluids through beds of solids.

Design I

Process Vessels—Mechanical design and fabrication of pressure vessels. Code and legal requirements. Supports for tall vertical, or horizontal vessels and their design.

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

Distillation and Absorption Equipment—Construction and design of sieve trays, bubble cap trays and plate towers. Selection of packing; design and construction of packed towers. 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, capitalized cost, optimization. Depreciation and taxation and their effect on economic analyses. Economic design.

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

Industrial Processes—A series of brief reviews of selected processing industries in which integration with other industries and present and forseeable trends of the industry are emphasized.

Corrosion and Materials—An elementary course in corrosion theory. Cathodic and anodic protection. Surface coatings. Materials of construction for chemical plant.

Principles II

TEXT BOOKS

Coulson and Richardson. *Chemical Engineering.* Vol. 2, Pergamon.
Foust, Wenzel, Clump, Maus and Andersen. *Principles of Unit Operations.* Wiley.
Kreith. *Principles of Heat Transfer.* International Text Book.
McAdam. *Heat Transmission.* McGraw-Hill.
Perry. *Chemical Engineers' Handbook.* McGraw-Hill.

REFERENCE BOOKS

Badger and Banchero. *Introduction to Chemical Engineering.* McGraw-Hill.
Henley and Staffin. *Stagewise Process Design.* Wiley, N.Y., 1963.
Larian. *Fundamentals of Chemical Engineering Operations.* Constable.
Norman. *Absorption and Distillation.*
Sherwood and Pigford. *Absorption and Extraction.* McGraw-Hill.
Treybal. *Mass Transfer Operations.* McGraw-Hill.

Design I

TEXT BOOKS

A.S. No. A1—1956 Structural Steel and Rolled Steel Sections. Standards Association of Australia.

A.S. No. CB.1, Part V—1951 S.A.A. Boiler Code, Part V—Welding. Standards Association of Australia.

Buchanan and Sinclair (edited by). *Costs and Economics of the Australian Process Industries.* West.

Perry. *Chemical Engineers' Handbook.* McGraw-Hill.

Peters. *Plant Design and Economics for Chemical Engineers.* McGraw-Hill.

S.A.A. Int. 351. Structural Steel in Building. Standard Association of Australia.

REFERENCE BOOKS

A.S. No. CA.2 (1938) Platforms, Gangways, etc. Standards Association of Australia.

A.S.M.E. *Boilers and Pressure Vessel Code.* Section 8 (1962).

B.H.P. *Catalogue of Rolled Steel Sections.*

Brownell and Young. *Process Equipment Design.* Wiley.

B.S. 1387. Steel Tubes and Tubulars, British Platforms. British Standards Institution.

B.S. 1500: 1958. Fusion Welded Pressure Vessels. British Standards Institution.

Hirschhorn. *Materials and Structures.* UNSW Students' Union.

Kellog, M. W. *Design of Piping Systems.*

Kern. *Process Heat Transfer.* McGraw-Hill.

Leva. *Packed Towers.* U.S. Stoneware.

Ludwig, E. E. *Applied Process Design for Chemical and Petrochemical Plants.* Gulf Publishing. Vols. 1-2-3, 1963-1966.

Rase. *Piping Design for Process Plants.* Wiley.

Rase and Barrow. *Project Engineering of Process Industries.* Wiley.

S.A.A. Int. 350. Minimum Design Loads in Buildings. Standards Association of Australia.

Siemon. *Pressure Vessel Manual.* 6th ed. Edwards Bros.

Tema. *Heat Exchangers Design Manual.* 3rd and 4th editions.

Dept. of Trade. *Income Tax for the Manufacturer.*

Tyler and Winter. *Chemical Engineering Economics.*

Vilbrandt and Dryden. *Chemical Engineering Plant Design.* 4th ed. McGraw-Hill.

Corrosion and Materials

TEXT BOOKS

Hayden, Moffat and Wulff. *Structure and Properties of Materials.* Vol. III. *Mechanical Behaviour.* Wiley.

Hayden, Moffat and Wulff. *Structure and Properties of Materials.* Scientific American, Freeman.

Hepner. *Materials of Construction for Chemical Plant.*

Moffat, Pearsall and Wulff. *Structure and Properties of Materials.* Vol. I *Structure.* Wiley.

Uhlig, H. H. *Corrosion and Corrosion Control.* Wiley.

REFERENCE BOOKS

Rumford. *Chemical Engineering Materials.*

Society of Chem. Ind., 1950. *Materials of Construction in the Chemical Industry.*

Speller. *Corrosion, Causes and Prevention.*

Uhlig. *Corrosion Handbook.*

3.123 Combined Chemical Engineering Principles and Design Examination

Tests the knowledge gained by B.Sc.(Tech.) students during studies and industrial training and is taken at the end of the course.

3.131 Chemical Engineering IIIA

Principles III

Extension of selected topics treated in Chemical Engineering II. Solution of problems using digital and analogue computers, relaxation and boundary layer methods and analytical solutions.

TEXT BOOKS

Bird, Stewart and Lightfoot. *Transport Phenomena.*
Coulson and Richardson. *Chemical Engineering.* Vols. 1 and 2. Pergamon.
Valentin. *Absorption in Gas-Liquid Disperson.* Spon, 1967.

REFERENCE BOOKS

Eckert. *Introduction to the Transfer of Heat and Mass.*
Foust, Clump, Wenzel, Maus and Andersen. *Principles of Unit Operations.* Wiley.
Holland. *Unsteady State Processes with Applications in Multicomponent Distillation.* Prentice-Hall.
Ipsen, D. C. *Units, Dimensions and Dimensionless Numbers.*
Johnstone, R. E. and Thring, M. W. *Pilot Plants, Models and Scale-up Methods.*
Langhaar. *Dimensional Analysis and Theory of Models.*
Othmer. *Fluidization.*
Robinson and Gilliland. *Elements of Fractional Distillation.*
Treybal. *Mass Transfer Operations.*

3.132 Chemical Engineering IIIB

Design II

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, capitalized cost, optimization. Depreciation and taxation and their effect on economic analyses. Economic design.

Plant Location—Topography, climate, transport, effluent disposal, relative location of markets and raw material sources, political environment.

Plant Layout—Principles, economic factors, use of drawings, three dimensional models and methods engineering.

Project Engineering—Management and critical path scheduling of the design, fabrication, procurement and erection of plant.

Civil Engineering Aspects—Qualitative treatment of soils and foundations for structures, buildings, storage tanks, and all free-standing columns. Economics of single, multi-stage and open air structures. Factory acts and codes. Access roads.

Pressure Vessels—Design and construction of vessels to contain high pressures and high temperatures. Monobloc cylinders, auto-frettage, wire and tape wound vessels, multi-shell constructions, end closures, seals and joints for high pressure vessels, transition stresses, economic considerations, nozzles, glands, auxiliary components, piping, valves, pumps and compressors for high pressure plant. Vessels for high temperature, stresses due to temperature gradients, creep, creep resistant materials, shell construction using two materials, wall temperatures.

Piping Design—Introduction to methods of flexural analysis for piping systems. Methods of reducing expansion and vibration reactions and stresses.

Process Engineering and Economic Design—The economic design of the major components of a projected chemical plant will be demonstrated in detail. The course will demonstrate, *inter alia*, the economic selection of the process, product effluent compositions, and optimum size and operating conditions of the various components of the battery.

Instrumentation and Automatic Control

Instrumentation—Important types of measuring instruments, principles governing their operation, selection and installation. Indicating and recording instruments. Pneumatic and electric controllers. Control valves and actuators and control valve sizing.

Process dynamics—Dynamics of flow processes, thermal processes, mass transfer processes and chemical processes. Ue of block diagrams and signal flow diagrams. Mathematical techniques for handling the equations involved.

Automatically-controlled processes—Fundamental principles of automatic control, and of the mathematical techniques for solving automatic-control problems.

Laboratory—Problems associated with measuring instruments (calibration, errors, installation, etc.), and a study of the properties of some of the components in controlled systems (lags performance characteristics, valve characteristics, etc.). Other work will involve the use of electronic and analogue equipment for simulating controlled processes. The use of the digital computer in similar problems.

Design II

TEXT BOOKS

Act No. 43 (1962) Factory, Shops and Industries Act, as amended by Act No. 58 (1964). Government Printer.

A.S. No. C.25 (1952) General Principles for Safe Working in Industry. Standards Association of Australia.

Buchanan and Sinclair (edited by). *Costs and Economics of the Australian Process Industries.* West.

Comings. *High Pressure Technology.* McGraw-Hill.

Industrial Ventilation. American Society of Govt. Indus. Hygienists, Washington, 1966.

REFERENCE BOOKS

Brownell and Young. *Process Equipment Design.* Wiley.

Kellog, M. W. *Design of Piping Systems.* Kellog.

Kern. *Process Heat Transfer.* McGraw-Hill.

Rase. *Piping Design for Process Plants.* Wiley.

Roark. *Formulas for Stress and Strain.* McGraw-Hill.

Timoshenko. *Theory of Elastic Stability.* McGraw-Hill.

Tongue. *Design of High Pressure Chemical Plant.* 2nd ed.

Instrumentation and Automatic Control

TEXT BOOK

Di Stefano, Stubberud and Williams. *Theory and Problems of Feedback Control Systems.*

REFERENCE BOOKS

Campbell. *Process Dynamics.*

Clark. *Introduction to Automatic Control Systems.* Wiley.

D'Azzo, J. J. and Houpis, C. H. *Feedback Control System Analysis and*

Synthesis. McGraw-Hill.
Eckman. *Automatic Process Control.* Wiley.
Perlmutter. *Introduction to Chemical Process Control.* Wiley.
Shilling. *Process Dynamics and Control.* Holt, Rinehart and Winston.
Smith and Wood. *Principles of Analog-Computation.* McGraw-Hill.

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.

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.

Part I

TEXT BOOK

Kent. *Technology of Cereals.* Pergamon.

REFERENCE BOOKS

Blanck. *Handbook of Food and Agriculture.* Reinhold.
Cruess. *Commercial Fruit and Vegetable Products.* McGraw-Hill.
Frazier. *Food Microbiology.* McGraw-Hill.
Hersom and Holland. *Canned Foods.* Churchill, London.
Howard. *Canning Technology.* Churchill, London.
Morris. *Principles of Fruit Preservation.* Chapman & Hall, London.
Stumbo. *Thermobacteriology in Food Processing.* Academic Press.
Tressler and Evans. *The Freezing Preservation of Foods.* 2 Vols. A.V.I. Publ. Co., Westport.
Tressler and Joslyn. *Fruit and Vegetable Juice Production.* A.V.I. Publ. Co.
Van Arsdel and Copley. *Dehydration.* 2 Vols. A.V.I. Publ. Co.

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.

Part II

TEXT BOOKS

Earle. *Unit Operations in Food Processing.* Pergamon.
Kent. *Technology of Cereals.* Pergamon.
Lawrie. *Meat Science.* Pergamon.

REFERENCE BOOKS

Meat and Meat Products. American Meat Institute Foundation. Freeman.
Andersen and Williams. *Margarine.* Pergamon.
Bailey. *Melting and Solidification of Fats.* Academic.
Bate-Smith and Morris. *Food Science.* Cambridge, U.P.
Borgstrom. *Fish as Food.* Vols. 1-4. Academic.
Davis. *Dictionary of Dairying.* Hill, London.
Frazier. *Food Microbiology.* McGraw-Hill.
Hlynka. *Wheat Chemistry and Technology.* Am. Assn. of Cereal Chem.
Honig. *Principles of Sugar Technology.* Elsevier, Amsterdam.
Jacobs. *Food and Food Products.* 3 Vols. Wiley.
Jensen. *Meat and Meat Foods.* Garrard, Champaign, Ill.
Jensen. *Microbiology of Meats.* Garrard.
Jenness and Patton. *Principles of Dairy Chemistry.* Wiley.
Mrak and Stewart. *Advances in Food Research.* Academic.
Romanoff and Romanoff. *The Avian Egg.* Wiley.
Swern. *Bailey's Industrial Oil and Fat Products.* Wiley.
Tanner. *Microbiology of Foods.* Garrard.
Tressler and Lemon. *Marine Products of Commerce.* A.V.I. Publ. Co.

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.

REFERENCE BOOKS

Amerine, Pangborn and Roessler. *Principles of Sensory Evaluation of Food.* Academic.
Burnham, Hanes and Bartleson. *Color: A Guide to Basic Facts and Concepts.* Wiley.
Charm. *Fundamentals of Food Engineering.* A.V.I. Publ. Co.
Crocker. *Flavour.* McGraw-Hill.
Goodwin. *The Comparative Biochemistry of the Carotenoids.* Chapman and Hall.
Harris and Von Loesecke. *Nutritional Evaluation of Food Processing.* Wiley.
Karrer and Jucker. *Carotenoids.* Elsevier, Amsterdam.
Little. *Flavour Research and Food Acceptance.* Reinhold.
Mackinney and Little. *Colour of Food.* A.V.I. Publ. Co.
Meyer. *Food Chemistry.* Reinhold.
Mrak and Stewart. *Advances in Food Research.* Academic.
NAS-NRC Publication 1273. *Radiation Preservation of Foods.* Nat. Acad. of Science, Washington.
Paech and Tracey. *Modern Methods of Plant Analysis.* 4 Vols. Springer, Berlin.
U.S.A. Quartermaster Food and Container Institute: 1. Colour in Foods; 2. Food Acceptance Testing Methodology; 3. Chemistry of Natural Food Flavours.
Webb. *Biochemical Engineering.* Van Nostrand, London.

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.

TEXT BOOKS
Earle. *Unit Processes in Food Engineering.* Pergamon.
Foust et al. *Principles of Unit Operations.* Wiley.

REFERENCE BOOKS
Andersen. *Automatic Refrigeration.* Danfoss.
Brown. *Unit Operations.* Wiley.
Charm. *Fundamentals of Food Engineering.*
McCabe and Smith. *Unit Operations in Chemical Engineering.* McGraw-Hill.

DEPARTMENT OF FUEL TECHNOLOGY

3.311 Fuel Science and Engineering I

Principles and processes of fuel technology.

Fuels: importance, costs, economics, availability, fields of application, relative advantages. Solid, liquid and gaseous fuels: origin, types, classification, storage, occurrence in Australia; introduction to standard specifications; sampling, testing and evaluation—significance of tests.

Processing and utilization of fuels: combustion, gasification, carbonization and manufacture of chemicals. Atmospheric pollution and control. The future outlook for fuels.

TEXT BOOK
Macrae. *An Introduction to the Study of Fuel.* Elsevier.

REFERENCE BOOKS
British Standards Institution. *B.S. 1016, Parts 1, 2, 3, 4, 5, 6, 12, 13, 15, and 16. B.S. 1017, Part 2.*
Inst. of Petroleum. *Modern Petroleum Technology.*
Ministry of Power (U.K.). *The Efficient Use of Fuel.* H.M.S.O.
Standards Association of Australia. *Australian Standard K153 : Part 1.*

3.321 Fuel Engineering II

Fundamental principles of combustion. Gaseous reactions; theory of chain reactions—free radicals in the gas phase. Kinetics of heterogeneous combustion reactions. Flames, flame propagation. Inflammability limits, cool flames and knock. Combustion in model fuel beds; reactivity and combustion of coke.

Combustion in practice: blast furnaces and cupolas; mechanical stoking. The burning of coal in suspension: characteristics of pulverized fuel, combustion mechanism, heat release and particle burning times. Combustion of liquid fuels: characteristics of importance; physical and chemical processes involved in the burning of "atomized" fuels. Mineral impurities in fuels and their significance. Ash fusibility, clinkering and slagging; deposits and corrosion: causes, measurement and control.

TEXT BOOKS
*Gaydon and Wolfhard. *Flames.* Chapman and Hall.
Smith and Stinson. *Fuels and Combustion.* McGraw-Hill.
*Thring. *The Science of Flames and Furnaces.* Chapman and Hall.
*Also needed in later courses.

REFERENCE BOOKS

A.S.M.E. Research Report. *Corrosion and Deposits in Coal—and Oil-fired Boilers and Gas Turbines.* Pergamon.
Dehnel. *Fundamentals of Boiler House Technique.*
Inst. of Fuel (Australian Membership). *Symposium on the Inorganic Constituents of Fuel (Origin, Influence and Control).* 1964.
Johnson and Littler. *The Mechanism of Corrosion by Fuel Impurities.* Butterworth.
Lewis and Von Elbe. *Combustion, Flames and Explosions of Gases.* Academic.
Lowry. *Chemistry of Coal Utilization.* Supplementary volume. Wiley, 1963.
Spiers. *Technical Data on Fuel.* W.P.C., 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.

Part I

TEXT BOOK

Eckman. *Automatic Process Control.* Wiley.

REFERENCE BOOKS

B.S. 1042. Part 1, 1964. *Measurement of Fluid Flow in Pipes.*
Eckman. *Industrial Instrumentation.* Wiley.
Gaydon and Wolfhard. *Flames.* Chapman and Hall.
McAdams. *Heat Transmission.* McGraw-Hill.
Spiers. *Technical Data on Fuel.* W.P.C., London.

Part II

TEXT BOOKS

Kern. *Process Heat Transfer.* McGraw-Hill.
Spiers. *Technical Data on Fuel.* W.P.C., London.

REFERENCE BOOKS

Etherington. *Modern Furnace Technology.* 3rd ed. Griffin.
Lyle. *The Efficient Use of Steam.* H.M.S.O., London.
Norton. *Refractories.*
Schack. *Industrial Heat Transfer.* Chapman and Hall.
Trinks. *Industrial Furnaces.* Vols. 1 and 2. Wiley.

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 Science and 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.

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.

Part I

TEXT BOOKS

*Gaydon and Wolfhard. *Flames.* 2nd ed. Chapman and Hall.
Johnson. *Automatic Process Control.* McGraw-Hill.
*McAdams. *Heat Transmission.* McGraw-Hill.
Shilling. *Process Dynamics and Control.* Holt, Rinehart & Winston.
*Spiers. *Technical Data on Fuel.* W.P.C., London.
*Thring. *The Science of Flames and Furnaces.* 2nd ed. Chapman and Hall.

*Texts from previous subject which should already be in the students' possession.

REFERENCE BOOKS

Etherington. *Modern Furnace Technology.* 3rd ed. Griffin.
Griswald. *Fuels, Combustion and Furnaces.* McGraw-Hill.
Kern. *Process Heat Transfer.* McGraw-Hill.
Spalding. *Some Fundamentals of Combustion.* Butterworth.
Trinks. *Industrial Furnaces.* Vol. 1 and 2. Wiley.

Part II

TEXT BOOK

Inst. of Petroleum. *Modern Petroleum Technology.*

REFERENCE BOOKS

Drinker and Hatch. *Industrial Dusts.* McGraw-Hill.
Francis. *Boiler House and Power Station Chemistry.* Arnold.
Gumz. *Gas Producers and Blast Furnaces.* Wiley.
Nelson. *Petroleum Refinery Engineering.* McGraw-Hill.
Sach (edited by). *Coal Tar Fuels.* Association of Tar Distillers, London.
Wilson and Wells. *Coal, Coke and Coal Chemicals.* McGraw-Hill.

Part III

TEXT BOOK

Van Krevelen. *Coal, Typology, Chemistry, Physics and Constitution.* Elsevier.

REFERENCE BOOKS

B.C.U.R.A. *Proceedings of a Conference on the Ultrafine Structure of Coals and Cokes.* 1944.
The Central Fuel Research Institute, India. *Proceedings of the Symposium on the Nature of Coal.* Jealgora, 1959.
Francis. *Coal: Its Formation and Composition.* 2nd ed. Arnold.
Institute of Fuel. *Residential Conference on Science in the Use of Coal.* Sheffield, 1958.
Lowry. *Chemistry of Coal Utilization.* Supplementary Volume. Wiley.
Van Nes and Van Westen. *Aspects of the Constitution of Mineral Oils.* Elsevier.

3.333 Fuel Engineering IIIM

For B.Sc.(Tech.) students. Covers the subject-matter of 3.331 Fuel Engineering IIIA and 3.332 Fuel Engineering IIIB, but with slightly reduced laboratory hours. The syllabus includes solids handling and coal density analysis.

The text and reference books for this subject are selected from those for 3.332 above.

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.

3.381 Principles of Fuel Engineering

Text and reference books are as for 3.311 Fuel Science & Engineering I.

3.382 Combustion Engineering

As for 3.321 Fuel Engineering II.

3.383 Fuel Plant, Evaluation and Assignments

Students are supplied with reading lists appropriate to individual requirements.

CHEMICAL ENGINEERING GRADUATE SUBJECTS

3.161G Corrosion Technology I

A technical survey of metals and non-metals from the viewpoint of types available and the corrosion properties, i.e., steels, irons, special ferrous alloys, non-ferrous metals and alloys, glass, plastics, ceramics, rubber, Cathodic and anodic protection. Inhibitors and passivitizers.

3.162G Corrosion Technology II

Applications of Corrosion Theory

Environmental and intrinsic factors encountered in corrosion and the design of plant to prevent or minimize corrosion. Atmospheric and gaseous corrosion. Aqueous and liquid media corrosion. Underground corrosion.

Corrosion Prevention

Application of corrosion prevention to pipelines, structures, factory equipment in chemical, food, metallurgical and other industries. Corrosion prevention in sea water, steam generation, canning, industry, etc.

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 Optimisation

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.

3.171G Corrosion Literature Assignment

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.

3.172G Corrosion Assignment

This will involve students in a small project connected with corrosion problems, i.e., examination of coatings and the reason for failure, examination of corrosion products, reasons for failure by corrosion, etc.

3.173G 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.

3.174G 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.

3.175G 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.

3.176G 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.

3.181G Heat, Mass and Momentum Transfer

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

TEXT BOOK

Coulson and Richardson. Vol. 1. *Chemical Engineering*. Pergamon.

REFERENCE BOOKS

Foust, Wenzel, Clump, Maus and Andersen. *Principles of Unit Operations*. Wiley.

Perry. *Chemical Engineers Handbook*. McGraw-Hill.

3.182G 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.

TEXT BOOKS
Aiba, Humphrey and Millis. *Biochemical Engineering.* Academic.
Levenspiel. *Chemical Reaction Engineering.* Wiley.
Perlmutter. *Introduction to Chemical Process Control.* Wiley.

REFERENCE BOOKS
Bray and White. *Kinetics and Thermodynamics in Biochemistry.* Churchill.
Mahler and Cordes. *Biological Chemistry.* Harper International Edition.
Pourbaix. *Atlas of Electrochemical Equilibrium Diagrams.* Pergamon.
Smith. *Chemical Engineering Kinetics.* McGraw-Hill.
Smith and Van Ness. *Introduction to Chem.Eng. Thermodynamics.* McGraw-Hill.
Webb. *Biochemical Engineering.* Van Nostrand.

3.183G Chemical Plan, Design and Operation

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

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

TEXT BOOKS
Aiba, Humphrey and Millis. *Biochemical Engineering.* Tokyo Univ.
Coulson and Richardson. Vol. II. *Chemical Engineering.* Pergamon.

REFERENCE BOOKS
Foust, Wenzel, Clump, Maus and Andersen. *Principles of Unit Operations.* Wiley.
Larian. *Fundamentals of Chemical Engineering Operations.* Constable.
Steel. *Biochemical Engineering.* Heywood.

3.191G Chemical Reactor Engineering I

Transport Phenomena in Reactors—Residence time distribution. Flow models. Non-ideal flow. Heat exchange in reactors. Tracer techniques. Mixing, dispersion, and segregation in reactors. Heterogeneous flow system —catalytic and fluidized-bed reactors. Mass transfer. Temperature gradients and concentration profiles.

Reactor Dynamics—Analysis of basic linear systems. Open loop and closed loop systems. Introduction of synthesis techniques. Characterization of dynamic systems based on transport phenomena and reaction kinetics. Prediction of instability.

Reactor Engineering Economics—Economic analysis of Australian process industries. Objective functions. Preliminary evaluation of capital requirements and estimation of associated costs.

REFERENCE BOOKS
Aris. *Introduction to the Analysis of Chemical Reactors.* Prentice Hall.
Astarita. *Mass Transfer with Chemical Reaction.* Elsevier.

3.192G Chemical Reactor Engineering II

Reactor Design and Control—Linearization of reactor systems. Analysis of non-linear systems. Synthesis techniques in reactor design. Design for control. Objective functions. Transient models. Scale-up in design. Transfer coefficients. Combined mechanisms. Industrial reactors.

Design Optimization—Selectivity. Reactor types and feed distribution. Temperature optimization. Dynamic models and design. Optimization of functional groups.

REFERENCE BOOKS

Fan. *The Continuous Maximum Principle.* Wiley.
Kramers and Westerterp. *Chemical Reactor Design and Operation.* Chapman & Hall.
Nemhauser. *Introduction to Dynamic Programming.* Wiley.
Petersen. *Chemical Reaction Analysis.* Prentice Hall.
Wilde and Beightier. *Foundations of Optimisation.* Prentice-Hall.

3.193G Industrial Process Kinetics

Kinetics and mechanisms particularly in the field of complex reactions.

TEXT BOOKS

Frost and Pearson. *Kinetics and Mechanisms.* Wiley.
Porter. *Progress in Reaction Kinetics.* Pergamon.

3.194G Kinetic Models and Parametric Studies

Advanced kinetics course involving extensive use of analogue computers.

REFERENCE BOOKS

Franks. *Mathematical Modelling in Chemical Engineering.* Wiley.
Rodiguin, N. M. and Rodiguina, E. N. *Consecutive Chemical Reactions.*
Wilde, D. J. and Beightier, C. S. *Foundations of Optimisation.* Prentice Hall, 1967.

3.195G Specialist Lectures

3.196G 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.

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.

FUEL TECHNOLOGY GRADUATE SUBJECTS

3.381 Principles of Fuel Engineering

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

Text and reference books are as for 3.311 Fuel Science and Engineering I.

3.382 Combustion Engineering

Similar to 3.321 Fuel Engineering II offered in the post-graduate diploma.

Text and Reference Books 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.

TEXT BOOK
Magill, Holden and Ackley. *Air Pollution Handbook.* McGraw-Hill.

REFERENCE BOOKS
Davies. *Breathing and Irrespirable Atmospheres.*
Davies. *Dust is Dangerous.* Faber and Faber.
Drinker and Hatch. *Industrial Dust.* 2nd ed. McGraw-Hill.
Faith. *Air Pollution Control.* Wiley.
McCabe (edited by). *Air Pollution.* McGraw-Hill.
Meetham. *Atmospheric Pollution.* 2nd ed. Pergamon.
Orr and Dalla Valle. *Fine Particle Measurement.* Macmillan.
Thring (edited by). *Air Pollution.* Butterworth.

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.

TEXT AND REFERENCE BOOKS
As for 3.332, Part III.

3.393G Fuel Engineering Plant Design

Extends some of the subject-matter of 3.331s/2 Fuel Plant Technology and Design.

TEXT AND REFERENCE BOOKS
As for 3.331, Part II.

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.

TEXT BOOKS
Inst. of Petroleum. *Modern Petroleum Technology.*
Johnson. *Automatic Process Control.* McGraw-Hill.
McAdams. *Heat Transmission.* McGraw-Hill.
Shilling. *Process Dynamics and Control.* Holt, Rinehart & Winston.

REFERENCE BOOKS
Gayden and Wolfhard. *Flames.* 2nd ed. Chapman and Hall.
Gumz. *Gas Producers and Blast Furnaces.* Wiley.
Spalding. *Some Fundamentals of Combustion.* Butterworth.
Wilson and Wells. *Coal, Coke and Coal Chemicals.* McGraw-Hill.

3.395G Research Techniques and Extension Methods

Designed to provide a critical approach to research activities. The topics are selected from the following:

(*a*) Advanced analytical techniques (e.g. spectroscopy, X-ray diffraction, chromatography, mass spectroscopy. N.M.R., other optical and instrumental methods. (*b*) Mathematical methods in the design and interpretation of experiments, e.g., formulation and solution of equations; statistical evaluation of results; empirical equations and nomographs; analogue simulation; an introduction to programming and use of digital computers.

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

SCHOOL OF CHEMICAL TECHNOLOGY

22.111 Industrial Chemistry I

(*a*) *Processes*—Review of services in the chemical industries; 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*) *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*) *Management Science*—Application of the principles of the feed-back control loop to management in the chemical industry and dealing with production, quality control, work study, production planning, economics and project development. (*d*) *Operations Research*—A study of the use of operations research in the chemical industry including linear programming, the transportation problem, inventory control techniques, applications of the queueing theory, use of the digital computer, brief discussion of network flow problems and dynamic programming. (*e*) *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. (*f*) *Data Processing*—Application of the principles of statistics to chemical problems (Z test, t test, F test and χ^2 test), analysis of variance, design of experiments, correlation and regression, quality control; use of graphical methods; fitting of empirical equations to experimental data; preparation of nomograms using constructional determinants. (*g*) *Laboratory*—Students will be required to attend lectures in report writing, carry out laboratory assignments and attend factory inspections at local and country centres as required.

REFERENCE BOOKS
Gyngell, E. S. *Applied Chemistry for Engineers.*
McCabe and Smith. *Unit Operations of Chemical Engineering.*
Brown. *Unit Operations.*
Badger and Banchero. *Introduction to Chemical Engineering.*
Delahay. *Instrumental Analysis.*
Strobel. *Chemical Instrumentation: A Systematic Approach to Instrumental Analysis.*

22.111/1 and 22.111/2 Industrial Chemistry I Parts 1 and 2

22.111 Industrial Chemistry I for part-time students in two parts over two years. Part I consists of sections (*a*) and (*b*) plus (*g*) laboratory. Part 2 consists of (*c*) to (*f*) inclusive.

Processes
22.111/1

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

REFERENCE BOOKS
Groggins. *Unit Processes in Organic Syntheses.*
Kobe, K. A. *Inorganic Process Industries.* Macmillan.
Rogers. *Industrial Chemistry.*

Chemical Process Equipment

REFERENCE BOOKS
Badger and Banchero. *Introduction to Chemical Engineering.*
Brown. *Unit Operations.*
McCabe and Smith. *Unit Operations of Chemical Engineering.*

22.111/2 Industrial Chemistry I

Chemical Thermodynamics and Kinetics

TEXT BOOKS
Smith and Van Ness. *Introduction to Chemical Engineering Thermodynamics.*
Smith. *Chemical Engineering Kinetics.*

REFERENCE BOOKS
Darken, L. S., and Gurry, R. W. *Physical Chemistry of Metals.* McGraw-Hill.
Kirkwood and Oppenheim. *Chemical Thermodynamics.*
Walas, S. M. *Reaction Kinetics for Chemical Engineers.*

Data Processing

TEXT BOOK
Allcock and Jones. *The Nomogram.*
Crow, Davis and Maxfield. *Statistics Manual.* Dover.

REFERENCE BOOKS
Davies. *Statistical Methods in Research and Production.*
Johnson. *Nomography and Empirical Equations.*
Worthing and Geffner. *Treatment of Experimental Data.*

22.112 Industrial Chemistry II

An advanced series of lectures dealing with some industries not covered in Industrial Chemistry I.

(*a*) Appropriate examples of industrial processes will be covered to illustrate the following: refractories; high-temperature chemistry; high-pressure processes (ammonia synthesis—thermodynamics and equipment); high-vacuum processes and molecular distillation; 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*) *Industrial Chemistry Seminar*—Students will be required to present papers on selected topics with the intention of developing their skill in oral expressions as well as their ability to evaluate critically and present logically information on selected topics. Opportunity will also be taken where appropriate to arrange for guest lecturers.

Processes

22.112/1

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

REFERENCE BOOKS
Kobe, K. A. *Inorganic Process Industries.* Macmillan.
Groggins. *Unit Processes in Organic Syntheses.*
Rogers. *Industrial Chemistry.*

Chemical Thermodynamics and Kinetics

22.112/2

TEXT BOOKS
Smith and Van Ness. *Introduction to Chemical Engineering Thermodynamics.*
Smith. *Chemical Engineering Kinetics.*

REFERENCE BOOKS
Darken, L. S., and Gurry, R. W. *Physical Chemistry of Metals.* McGraw-Hill.
Walas, S. M. *Reaction Kinetics for Chemical Engineers.* McGraw-Hill.
Kirkwood and Oppenheim. *Chemical Thermodynamics.*

Data Processing

TEXT BOOKS
Crow, Davis and Maxfield. *Statistics Manual.* Dover.
Allcock and Jones. *The Nomogram.*

REFERENCE BOOKS
Johnson. *Nomography and Empirical Equations.*
Davies. *Statistical Methods in Research and Production.*
Worthing and Geffner. *Treatment of Experimental Data.*

22.131 Industrial Chemistry (Processes)

For the description of this subject see section (*a*) Processes, of 22.111 Industrial Chemistry I. 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.

Ceramics 1a
22.211/1

REFERENCE BOOKS

American Ceramic Society. *Phase Diagrams for Ceramists.* 1964.
Andrews. *Ceramic Tests and Calculations.* Wiley, 1955.
Findlay, Campbell and Smith. *Phase Rules.* Dover, 1951.
Heath and Green. *A Handbook of Ceramic Calculations.* Webberley, 1937.
Norton. *Elements of Ceramics.* Addison-Wesley, 1952.
Salmang. *Ceramics—Physical and Chemical Fundamentals.* Butterworth, 1961.

Ceramics 1b
22.211/2

REFERENCE BOOKS

Andrews, A. J. *Porcelain Enamels.* Garrard Press, 1961.
Campbell and Sherwood. *High Temperature Technology.* Wiley, 1967.
Chesters. *Steelplant Refractories.* United Steel.
Eitol. *Physical Chemistry of Silicates.*
Goldman. *Science of Engineering Materials.* Wiley.
Green and Stewart. *Ceramics: A Symposium.* British Ceramic Soc., 1953.
Kingery. *Introduction to Ceramics.* Wiley, 1960.
Klug and Alexander. *X-ray Diffraction Procedures.* Wiley.
Norton. *Refractories.* McGraw-Hill, 1949.
Parmelee. *Ceramic Glazes.* Industrial Publications, 1951.
Ryshkewitch, E. *Oxide Ceramics: Physical Chemistry and Technology,* 1960.
Searle and Grimshaw. *The Chemistry and Physics of Clays and Other Ceramic Materials.*

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.*

REFERENCE BOOKS

Darken and Gurry. *Physical Chemistry of Metals.* McGraw-Hill, 1953.
Evans. *Crystal Chemistry, Introduction to.*
Green. *Industrial Rheology and Rheological Structure.*
Gray. *The Defect Solid State.* Interscience, 1957.
Kern. *Process Heat Transfer.* McGraw-Hill.
Kingery. *Ceramic Fabrication Processes.* Wiley.
McKenzie. *Modern Aspects of the Vitreous State.* Butterworth.
Sinnott. *Solid State for Engineers.*
Smoluchowski. *Phase Transformations in Solids.*
Stanworth. *Physical Properties of Glass.*

22.221 Chemical Thermodynamics and Kinetics

For the description of this subject, see section (*e*), Chemical Thermodynamics and Kinetics, of 22.111 Industrial Chemistry.

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 22.112 Industrial Chemistry II.

22.251 Operations Research and Seminars

For the description of this subject, see section (*d*), Operations Research, of 22.111 Industrial Chemistry I.

22.311 Polymer Science I

Industrial Polymerization Processes—Classification of polymers, processes and methods used in the conversion of monomers to polymers. Naturally, occurring polymeric materials. *Polymerization Mechanisms I*—Mechanisms and kinetics of condensation and free radical polymerization reactions. Molecular weights. Fractionation of high polymers. *Polymer Physics I*—A study of the 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.

TEXT BOOKS

Allen. *Characterisation of High Polymers.* Butterworth.
Flory. *Principles of Polymer Chemistry.* Cornell University Press.
Lenz. *Organic Chemistry of Synthetic High Polymers.* Interscience/Wiley, 1967.
Margerison and East. *Introduction to Polymer Chemistry.* Pergamon Commonwealth and International Library Series, 1967.
Schmidt and Marlies. *Principles of High Polymers—Theory and Practice.*

REFERENCE BOOKS

A.S.T.M. Standards. Part IX.
Billmeyer. *Textbook of Polymer Science.* Wiley.
British Standards.
Eirich. *Rheology Theory and Application.* Vols. I, II and III.
Frith and Tuckett. *Linear Polymers.*
Ott, E. *Cellulose.* Interscience.
Payne. *Organic Coating Technology.* Vol. I. Wiley.
Reiner. *Deformation and Flow.*
Schildknecht. *Vinyl and Related Polymers.* Interscience.
Tompa. *Polymer Solutions.*
Treloar. *The Physics of Rubber Elasticity.*

22.312 Polymer Science II

Polymerization Mechanisms II—Advanced study of the mechanisms of polymerization processes; degradation; polymer solutions. *Polymer Analysis*—The use of modern instrumental methods for establishing the composition and structure of high polymers. *Polymer Physics II*—Properties of polymer solutions, advanced rheological considerations of polymer processing operations.

TEXT BOOK
Schmidt and Marlies. *Principles of High Polymers—Theory and Practice.*
REFERENCE BOOKS
A.S.T.M. Standard. Part IX.
Eirich. *Rheology Theory and Application.* Vols. I, II and III.
Houwink, R. *Elastomers and Plastomers.* Vols. I and II.
Kappelmeyer. *Chemical Analysis of Resin-based Coating Materials.* Interscience.
Kline. *Analytical Chemistry of Polymers Part I.* Interscience.
Schildknecht. *Vinyl and Related Polymers.* Interscience.
Tompa. *Polymer Solutions.*

22.321G Polymer Engineering I

(*a*) *Polymer Compound Design*—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.

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 (rigid); epoxy chemical resistant coatings; surface coating formulation and testing.

(*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.

Mixing processes (2 and 3-roll mills and Banbury mixer) dispersion processes (Sigma arm mixer); press moulding of thermosets; injection moulding of polyethylene and nylon: screw extrusion of thermoplastics (1½" extruder); screw extrusion of elastomers (1¼" extruder); screwless extrusion of thermoplastics; vacuum forming from sheet material; hot gas welding of thermoplastics; hot sealing of plastic films.

(*c*) *Physical Testing I*—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.

(*d*) *Laboratory*—Selected experiments illustrating principles developed in lectures.

TEXT BOOKS
Billmeyer. *Textbook of Polymer Science.* Wiley.
Schildknecht. *Vinyl and Related Polymers.* Interscience, *or*
Schmidt and Marlies. *Principles of High Polymers—Theory and Practice.*

22.322G Polymer Engineering II

(*a*) *Polymer Physical Properties*—Physical properties in relation to—linear structure, branch structure, cross-linked structure; molecular weight and distribution functions; molecular orientation for reinforcement; 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.

(*b*) *Engineering Applications of Polymers*—Thermosets; thermoplastics; elastomers; cellular polymers; adhesives and bonding; surface coatings;

thermal and acoustic insulation; vibration isolation; chemical resistance; artificial ageing.

(*c*) *Physical Testing II*—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.

REFERENCE BOOKS

Eirich. *Rheology Theory and Application.* Vols. I, II and III.
Frith and Tuckett. *Linear Polymers.*
Houwink, R. *Elastomers and Plastomers.* Vols. I and II.

22.331G Polymer Chemistry I

(*a*) *Processes*—Classification of polymers; methods of polymerization—bulk, suspension, emulsion, high pressure; processes—addition, condensation; the chemistry and applications of polymer systems including—polyesters, vinyl polymers, phenolic condensation resins, synthetic rubbers and elastomers, fluorinated polymers. Introduction to natural polymers.

(*b*) *Mechanisms*—Polycondensation—kinetics, structure effects; free radical polymerization—chemistry and properties of free radicals, initiators, kinetics, transfer reactions; copolymerization; ionic polymerization including stereoregular polymers; introduction to molecular weight determinations and fractionation.

(*c*) *Analysis*—Instrumental methods; ultraviolet spectroscopy, infra-red spectroscopy, end group analysis, vapour phase chromatography, degradation, X-rays, radio-isotopes, stereoisomers. Chemical methods.

Molecular weights by: viscosity, end group analysis, osmometry, ebulliometry, cryoscopy. Fractionation by precipitation, turbidimetry, elution, Instrumental analytical methods.

(*d*) *Laboratory*—Selected experiments illustrating principles developed in lectures.

TEXT BOOKS

Allen. *Characterisation of High Polymers.* Butterworth.
Flory. *Principles of Polymer Chemistry.* Cornell.
Lenz, R. W. *Organic Chemistry of Synthetic High Polymers.* Interscience/Wiley, 1967.
Margerison and East. *Introduction to Polymer Chemistry.* Pergamon Commonwealth and International Library Series, 1967.

REFERENCE BOOKS

Billmeyer. *Textbook of Polymer Science.* Interscience.
Fettes. *Chemical Reactions of Polymers.* Interscience, 1964.
Kline. *Analytical Chemistry of Polymers.* Interscience.
Long. *The Production of Polymer and Plastics Intermediates from Petroleum.* Butterworth, 1967.

22.332G Polymer Chemistry II

(*a*) *Structure and Characterisation*—Thermodynamics of polymer solutions; properties in solution as basis of molecular weight determination; polymer crystals; optical rotatory dispersion; fluorescence; differential thermal analysis; use of films; ultra centrifugation microtacticity fractionation; advanced kinetics—radical reactivity and structure; stereo-regular catalysis; relation of structure to mechanical properties; degradation of polymers; surface properties.

(*b*) *Natural Polymers*—Proteins and synthetic polypeptides—molecular structure, effect of structure on physical properties and behaviour in biological systems; synthetic methods, collagen. Carbohydrates—cellulose and related polymers.

(*c*) *Inorganic Polymers*—Silicones; arsenic polymers; phosphorus polymers; nitrogen polymers (not proteins); miscellaneous.

Advanced kinetics; free radical polymerization in bulk; free radical polymerization in emulsion; free radical polymerization in suspension; ionic polymerization; use of osmosis or viscosity to determine fundamental parameters; degradation—thermal (use of G.P.C.), ionising radiation. Characterization—Electron microscope, optical rotatory dispersion, films differential thermal analysis, optical methods, fluorescence methods, X-rays.

(*d*) *Laboratory*—Selected experiments illustrating principles developed in lectures.

TEXT BOOK

Sharples. *Introduction to Polymer Crystallization*. Arnold, 1966.

REFERENCE BOOKS

Hunter. *Inorganic Polymers*. Interscience/Wiley, 1964.
Ke. *Newer Methods of Polymer Characterization*. Interscience/Wiley, 1964.
Meares. *Polymers: Structure and Bulk Properties*. Van Nostrand, 1965.

22.351G Organic Surface Coatings (Corrosion Technology Course)

Chemistry and function of major components in various surface coatings. Mechanical and chemical test procedures.

SCHOOL OF GEOGRAPHY

27.001 Applied Geography I

Introduces the physical basis of geography. Solar energy and the heat balance. Bases of first-order relief. Rocks and rock-weathering in relation weather types. World climatic patterns. Hydrologic cycle and the water balance. Major rock types and their landform expression. Structural bases of relief. Mass movement and slope form, river action and valley features. Concepts of landscape evolution. Coastal processes and forms. Soil properties and classes. Distribution of soil types. Soils in the landscape. Vegetation dynamics. Patterns of natural vegetation. Man as a physical geographic agent. Examples of major ecosystems illustrating the interaction of physical and biological factors. Use and construction of maps. Analysis and depiction of geographic data. Elementary air-photo analysis.

Three one-day field tutorials must be attended.

TEXT BOOKS

Branagan, D. F. and Packham, G. H. *Field Geology of New South Wales*. Science Press.
Corbett, J. R. *The Living Soil*. Martindale Press.
CSIRO. *The Australian Environment*. Melbourne U.P.
Gregory, S. *Statistical Methods for the Geographer*. Longmans.
Hare, F. K. *The Restless Atmosphere*. Hutchinson.
Monkhouse, F. J. and Wilkinson, H. R. *Maps and Diagrams*. Methuen.
Odum, E. P. *Ecology*. Modern Biology Series.
Twidale, C. R. *Geomorphology*. Nelson Paperback.

REFERENCE BOOKS

Barry, R. G. and Chorley, R. J. *Atmosphere, Weather and Climate*. Methuen.

Bureau of Meteorology. *Manual of Meteorology.*
Gentilli, J. *Sun, Climate and Life.* Jacaranda Press.
Leeper, G. W. *Introduction to Soil Science.* Melbourne U.P.
Pettersen, S. *Introduction to Meteorology.* McGraw-Hill.
Riehl, H. *Introduction to the Atmosphere.* McGraw-Hill.
Riley, D. and Young, A. *World Vegetation.* C.U.P.
Shields, A. J. *Australian Weather.* Jacaranda Press.
Stephens, C. G. *Manual of Australian Soils.* CSIRO.
Strahler, A. N. *Physical Geography.* Wiley, International Edition.
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 Paperback.

27.002 Applied Geography II

Part I. *Geographic Methods and Models:* Aims and methods of enquiry; classifications in geography; input-output models; distribution patterns and areal associations; nodes, linkages and flows; principles of establishment and diffusion of geographic phenomena. Laboratory classes provide the statistical bases for the course and related case studies.

TEXT BOOKS

Haggett, P. and Chorley, R. eds. *Socio-economic Models in Geography.* Methuen Paperback.
Hare, F. K. *The Restless Atmosphere.* Hutchinson.
Huntsberger, V. *Elements of Statistical Inference.* Allyn & Bacon.
Siegel, S. *Non-parametric Statistics.* McGraw-Hill Paperback.

REFERENCE BOOKS

Ackoff, R. L. *Scientific Methods.* Wiley.
Berry, B. J. *Geography of Market Centers and Retail Distribution.* Prentice-Hall Paperback.
CSIRO. *The Australian Environment.* Melbourne U.P.
Elton, C. S.*The Ecology of Invasions by Animals and Plants.* Methuen.
Gates, D.C. *Energy Exchange in the Biosphere.* Harper & Row.
Haggett, P. and Chorley, R. *Models in Geography.* Arnold.
Haggett, P. *Locational Analysis in Human Geography.* Methuen.
Leopold, L. B., Wolman, M. G. and Miller, J. P. *Fluvial Processes in Geomorphology.* Freeman.
Odum, E. P. *Ecology.* Modern Biology Series.

Part II. *Regional Systems:* The individual enterprise: the metropolitan region and its hinterland; associations at international and inter-continental scales. Emphasis will be placed on Sydney, south-eastern Australia, and the south-west Pacific and south-east Asian areas. Themes treated at various regional scales will include man-modified landscapes, planned development and policy effects. the geography of under-development, conservation of resources and patterns of international trade and aid.

TEXT BOOKS

Rose, A. J. *Patterns of Cities.* Nelson Paperback.
Rutherford, J., Logan, M. I. and Missen, G. J. *New Viewpoints in Economic Geography.* Martindale Press.

REFERENCE BOOKS

Davidson, B. R. *The Northern Myth.* Melbourne U.P. Paperback.
Fisher, C. A. *South-East Asia.* Methuen.
Heathcote, L. *Back of Bourke.* Melbourne U.P.
Hodder, B. W. *Economic Development in the Tropics.* Methuen Paperback.
Howlett, D. *A Geography of Papua and New Guinea.* Nelson Paperback.
Hunter, A. *Economics of Australian Industry.* Cheshire.
Perry, T. M. *Australia's First Frontier.* Melbourne U.P.

Part III. *Case Study:* Conduct of a locally-based field project in economic and social geography. Comprising 15 weekly seminar or field sessions in the second part of the year and covering the design and conduct of the project, data collection and handling, and the reporting of results.

Preliminary reading will be set during First Term.

NOTE: Attendance at two field tutorials will be compulsory: a four-day tutorial at the end of Second Term involving studies of the structure and function of an urban and/or industrial complex and its impact on the adjacent agricultural area, and a one-day excursion to observe soil and vegetation. Approximate cost: $20.00.

27.003 Techniques in Physical Geography*

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

Geomorphology: form elements of slopes, stream channels, floodplains and terraces, beaches and dunes; measurement of processes; interpretation of superficial deposits; analysis of maps and airphotos; classification and mapping of land types.

Field ecology: vegetation description; sampling for stand comparisons and biomass studies.

Pedology: soil properties and constituents; factors and processes of soil formation; soil classification; morphology and genesis of zonal and intrazonal soils with particular reference to Australia; nutrients in the soil.

A four-day field tutorial for field observations in climatology, geomorphology, pedology and plant ecology.
* To be introduced in 1970.

27.013 Environmental Relationships in Physical Geography

Lithologic control of landforms, soils and vegetation in a range of climatic settings. The operation of the energy and water balances in the ecosystem: the hydrologic cycle in the landscape. Ecosystem status and dynamics; environmental aspects of soil fertility and its expression in vegetation, and the relevant cycling processes. Sequence in the environment; interrelated developmental stages of selected geomorphic, pedologic and biogeographical phenomena. The definition and mapping of natural landscapes; physical regions in Australasia and New Guinea. Methods of area analysis and areal correlation. Airphoto and map interpretation in environmental studies; analysis of plants and soils in ecosystematic investigations; regional climatological analysis; laboratory studies of rocks, weathering forms and soils.

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 Theory of Urban Settlement*

Explores theories of the composition and structure of the hierarchy of urban places in economically advanced and underdeveloped regions. Considers geographic relationships between urban places and relationships within the urban place itself. Specific topics include: classifications of the urban hierarchy of places by size and function; classical and modern central place theory; the urban economic base and stochastic models of growth or decline of urban places (including rural depopulation and suburbanization); and theories of land use zonation and efficiency within urban areas. Laboratory sessions include case studies of characteristic urban environments.

* To be introduced in 1970.

27.304 Advanced Urban Geography*

Recent developments in urban geography with particular emphasis on application to Australia, the south-west Pacific and south-east Asia. The role of the geographer in urban planning agencies, the design of urban land use classifications and maps, and the projection of future land use patterns. Computer storage and processing of data. Laboratory sessions examine the land use components of planning schemes in a range of environments.

* To be introduced in 1971.

27.313 Location Theory*

Classical and more recent adaptations of location theory relevant to primary, secondary and tertiary industrial activities. Throughout, the location of enterprise is regarded as an exercise in cost-benefit analysis. Specific topics include: decision theory relevant to location, normative location models based on rent theory and transfer cost, theories of regional specialization of production, models of general and partial equilibrium (input-output and optimal programming models), and stochastic models of industrial location patterns. Laboratory sessions include case studies and examples of practical application.

* To be introduced in 1970.

27.323 Transport and Marketing Geography*

Functional aspects of the location and use of transport systems relevant to the broad spectrum of transport media, and the spatial behaviour of consumers in the market for various types of goods and services. Special attention is given to decision theory relevant to route selection, topological analysis of route networks, and the models of transport route usage. Attention is given to theories of consumer spatial behaviour relevant to the optimal location of consumer-oriented enterprise. The selection of communication strategies appropriate to regionally differentiated groups of consumers. Models of the spatial diffusion of innovations and information. Laboratory sessions include case studies and examples of practical application.

* To be introduced in 1970.

27.403 Geomorphology and Pedology*

Zonal morphogenetic systems; coastal, volcanic and neotectonic landforms; soil properties and constituents; comparative morphology and genesis of zonal and intrazonal soils; soil stratigraphy; polygenetic soils; soil-landscape associations; classification and mapping of landforms and soils; geomorphic and soils surveys; morphometry and airphoto interpretation.

Two two-day field tutorials will be devoted to the study of landforms and soils in south-eastern Australia.

* To be introduced in 1970.

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 preweathering 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 1971.

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.

TEXT BOOKS

Leopold, L. B. Wolman, M.G., and Miller, J. P. *Fluvial Processes in Geomorphology*. Freeman.

Thornbury, W. D. *Principles of Geomorphology*. International edition. Wiley.

REFERENCE BOOKS

C.S.I.R.O. *The Australian Environment*. Melbourne U.P.

Jennings, J. N. and Mabbutt, J. A. (eds.). *Landform Studies from Australia and New Guinea*. A.N.U.

King, C. A. M. *Techniques in Geomorphology*. Arnold.

Mabbutt, J. A. *Lands of the Wiluna-Meekatharra Area, Western Australia*. C.S.I.R.O. Land Res., Series No. 7.

Ven te Chow. *Handbook of Applied Hydrology*. McGraw-Hill.

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.

TEXT BOOKS

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

Cottrell, A. H. *An Introduction to Metallurgy*. Arnold.

Dennis, W. H. *Extractive Metallurgy*. Pitman.

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

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*. Melbourne U.P.

Darken, L. S. and 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*. American Society for Metals.

Gilchrist, J. D. *Fuels and Refractories*. Pergamon.

Hollomon, J. and Jaffe, L. *Ferrous Metallurgical Design*. Wiley.

Kehl, G. L. *Principles of Metallographic Laboratory Practice.* 3rd Edition. McGraw-Hill.
McGannon, H. E. *The Making, Shaping and Treating of Steel.* 8th ed.. United States Steel.
Perry. J. H. *Chemical Engineers' Handbook.* McGraw-Hill.
Rhines, F. N. *Phase Diagrams in Metallurgy.* McGraw-Hill.
Woodcock. J. T. ed. *Vol. 3 Eighth Commonwealth Mining and Metallurgical Congress Publications.* Australasian Institute of Mining and Metallurgy.

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.

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.

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 First Term, and the report submitted not later than the end of the fifth week of Third Term.

TEXT AND REFERENCE BOOKS FOR 4.012, 4.012/1 and 4.012/2.

TEXT BOOKS

As for 4.011 Metallurgy I, together with—

Barrett, C. S. *Structure of Metals.* 3rd Edition. 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. *Introduction to Dislocations.* Pergamon.
Mann, J. Y. *Fatigue of Materials.* Melbourne U.P., 1967.
Swalin. *Thermodynamics of Solids.* Wiley.

REFERENCE BOOKS

As for 4.011 Metallurgy I, together with—

Bain, E. C. and Paxton, H. W. *Alloying Elements in Steel.* 2nd Edition, 1961. American Society for Metals.
Birchenall. C. E. *Physical Metallurgy.* McGraw-Hill.
Bockris, J. O'M., White, J. L. and Mackenzie, J. D. *Physiochemical Measurements at High Temperatures.* Butterworth.
Bodsworth and Appleton. *Problems in Applied Thermodynamics.* Longmans.
Burkin. *Chemistry of Hydrometallurgical Processes.* Spon.
Campbell, I. E. *High Temperature Technology.* Wiley.
Clark and Varney. *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.* American Society for Metals.
Hinsley, J. F. *Non Destructive Testing.* Macdonald and Evans.
Hume-Rothery, W. *Atomic Theory for Students of Metallurgy.* The Institute of Metals, London.
Hutchison, T. S. and Baird, D. C. *Physics of Engineering Solids.* 2nd ed. Wiley.
Kreith. *Principles of Heat Transfer.* International Textbook.
Levenspiel. *Chemical Reaction Engineering.* Wiley.
Read, W. T. *Dislocations in Crystals.* McGraw-Hill.
Schuhmann. *Metallurgical Engineering, Vol. I.* Addison Wesley.
Sefarian. *The Metallurgy of Welding.* Chapman and Hall.
Shewman, P. G. *Diffusion in Solids.* McGraw-Hill, 1963.
Shreir, L. L. *Corrosion, Vols. I and II.* Newnes.
Smallman, R. E. *Modern Physical Metallurgy.* Butterworth.
Tetelmann, A. S. and McElivy, A. J. *The Fracture of Structural Materials.* Wiley.
Udin, Funk and Wulff. *Welding for Engineers.* Wiley.
Wagner, C. *Thermodynamics of Alloys.* Addison-Wesley.
Zener, C. ed. *Thermodynamics in Physical Metallurgy.* A.S.M.

For Text and Reference Books for "Mineral Dressing" section of 4.012 and 4.012/1 ,see under 7.311 "Mineral Processing" (School of Mining Engineering).

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 imper-

fections, with reference to deformation, work hardening, annealing and radiation damage; X-ray and neutron diffraction; phase transformations; fracture mechanisms; and the design of engineering materials.

(*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.

TEXT AND REFERENCE BOOKS

As for 4.011 Metallurgy I and 4.012 Metallurgy II, together with—

Christian. *Theory of Transformations in Metals and Alloys.* Pergamon.

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

I.M.M., London. *Advances in Extractive Metallurgy.*

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.

4.111G Corrosion Metallurgy I

Electrochemical mechanisms, electrode potentials, polarization and corrosion rate, passivity. Effect of aqueous environment on corrosion rate, i.e., dissolved oxygen, anaerobic bacteria, temperature, pH, galvanic coupling, dissolved salts. Stress corrosion and corrosion fatigue. Theory of inhibition.

4.112G Corrosion Metallurgy II

The behaviour of metals in specific environment, stress, corrosion, corrosion fatigue, high temperature gas and liquid corrosion. Alloy selection, metal coatings.

Metallographic procedures, X-ray and electron diffraction, X-ray fluorescent analysis and electron microprobe identification of corrosion products.

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. Fuels and refractories.

TEXT BOOK
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

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.

TEXT BOOKS
As for 4.911 Materials Science, together with—
Wulff, J. ed. *Structure and Properties of Materials.* Vol. 4. Wiley.

REFERENCE BOOKS
Azaroff, L. V. and Brophy, I. J. *Electronic Processes in Materials.* McGraw-Hill.
Pfann, W. G. *Zone Melting.* Wiley.

4.931 Metallurgy

For students of Civil Engineering. Included as Part (*c*) in the syllabus for 8.221 and 8.221S Engineering Materials.

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

Text Books as for 4.911 Materials Science.

4.941 Materials

The structure and properties of solids, with special reference to those which are of use to the engineer, including metals and alloys, ceramics and polymers. Forms part of 8.251 Properties of Materials.

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 MINING ENGINEERING

7.110 Mineral Resources

Salient data on the mineral industry, fuels, metals, industrial minerals. Legislation, Government assistance and controls. Primary treatment, smelting, refining; production of basic commodities for industry. Investment, employment, wages, taxation. International developments: pattern of mineral trade.

TEXT BOOKS

Fullard, H. *Atlas of the World.* E.U.P.

Com. of Aust. *The Australian Mineral Industry 1966 Review.* Bur. of Min. Res.

REFERENCE BOOKS

Kalix, A., Fraser, L. M. and Rawson, R. L. *Australian Mineral Industry Production and Trade 1842-1964.* Bur. of Min. Res.

McLeod, I. R. *Australian Mineral Industry: The Mineral Deposits.* Bur. of Min. Res.

Brown, D. A., Campbell, K. S. W. and Crook, K. A. W. *The Geological Evolution of Australia and New Zealand.* Pergamon.

7.111S Mining Engineering I

Part 1—Mining as a major primary industry. Introduction to mining engineering; mining law; explosives; drilling; blasting.

Part 2—Mine development: shaft sinking and tunnelling: materials used for mine support. Introduction to the organization and programming of mining techniques. Surface methods of mining.

Part 3—Underground methods of mining: coal mining; metalliferous mining: non-entry methods of mining; petroleum production engineering. Conservation of reserves. Seminar on methods of mining. Industrial Report.

7.111/1; 7.111/2; 7.111/3 Mining Engineering Parts 1, 2 and 3

For students in the B.Sc.(Tech.) course; based on the syllabus of 7.111 and taken in three parts over three years.

PRELIMINARY BACKGROUND READING

(Selected reading from this book list for First and Second Year Students.)

Blainey, G. *The Peaks of Lyell.* A. and R.

Commonwealth of Australia. *The Australian Mineral Industry Review, 1938.* Bureau of Mineral Resources.

Farwell, G. M. *Down Argent Street.* Johnson, Sydney.
Hoover, H. C. *The Memoirs of Herbert Hoover, 1874-1920 Years of Adventure.* Macmillan.
Lovering, T. S. *Minerals in World Affairs.* Prentice-Hall.
McLeod, I. R. *Australian Mineral Industry: The Mineral Deposits.* Bur. of Res.
Morrell, W. P. *The Gold Rushes.* A. and C. Black.
Woodward, O. H. *A Review of the Broken Hill Lead, Silver and Zinc Industry.* A.I.M.M. Melbourne.

TEXT BOOKS

Fox, A. F. *The World of Oil.* Pergamon.
Sinclair, J. *Winning Coal.* Pitman.
Higham, S. *An Introduction to Metalliferous Mining.* Griffin, *or*
Lewis, R. S. and Clark, G. B. *Elements of Mining.* Wiley, *or*
Woodruff, S. D. *Methods of Working Coal and Metal Mines.* 3 vols, Pergamon.

REFERENCE BOOKS

(i) Statistics

Arkin, H. and Colton, R. R. *Statistical Methods.* Barnes & Noble.
Bross, I. D. J. *Design for Decision.* Macmillan.
Deming. *Some Theory of Sampling.* Wiley.
Moroney, M. J. *Facts from Figures.* Penguin.
Weatherburn, C. E. *A First Course in Mathematical Statistics.* Cambridge.

(ii) Drilling

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

(iii) Geophysics

Dobrin, M. R. *Introduction to Geophysical Prospecting.* McGraw-Hill.
Howell, B. F. *Introduction to Geophysics.* McGraw-Hill.

(iv) Economics

Truscott, S. J. *Mine Economics.* Mining Publications.

(v) Explosives and Blasting

Atlas Copco Ltd. *Manual of Rock Blasting.* Stockholm.
Dupont de Nemours, E. I. and Co. Inc. *Blasters Handbook.*
Gregory, C. E. *Explosives for Engineers.* Queensland University Press.
Langefors and Kohlstrom. *Rock Blasting.* Wiley, N.Y.
McAdam and Westwater. *Mining Explosives.* Oliver and Boyd.

(vi) Mine Equipment

Bryson, T. *Mining Machinery.* Pitman.
Compressed Air & Gas Institute, N.Y. *Compressed Air Handbook.*

(vii) Mining Practice

Beringer, B. *Underground Practice in Mining.* Mining Publications.
Eaton, L. *Practical Mine Development and Equipment.* McGraw-Hill.
Eighth Commonwealth Mining and Metallurgical Congress, 1965. *The Australian Mining, Metallurgical and Mineral Industry.* A.I.M.M. Melbourne.
Fifth Empire Mining & Metallurgical Congress, 1953. *Coal in Australia.* A.I.M.M. Melbourne.
Fifth Empire Mining & Metallurgical Congress, 1953. *Mining Methods in Australia and Adjacent Territories.* A.I.M.M. Melbourne.
Fritzsche, G. H. and Pott, E. L. J. *Horizon Mining.* Allen & Unwin.
Jackson, C. F. and Hedges, J. H. *Metal Mining Practice.* U.S. Bureau of Mines Bulletin, No. 419.

Shevyakov, L. *Mining of Mineral Deposits.* Peace Publishers.
Statham, I. C. F. *Coal Mining.* English U.P.
Stoces, B. *Introduction to Mining.* 2 vols. Pergamon.
Stoces, B. *Atlas of Mining Methods.* 2 vols.
Whitaker, J. W. and Willett, H. L. *Colliery Explosion and Recovery Work.* Pitman.

(viii) Tunnelling

Howett, B. H. M. and Johannesson, S. *Shield and Compressed Air Tunnelling.* McGraw-Hill.
Inst. of Mining, Met. London. *Symposium on Shaft Sinking and Tunnelling, 1959.*
Proctor and White. *Rock Tunnelling with Steel Supports.* Commercial Shearing & Stamping Co.
Sandstrom, G. E. *The History of Tunnelling.* Barrie & Rockliff.

(ix) Alluvial Mining

Griffith, S. V. *Alluvial Prospecting and Mining.* Mining Publications.
Harrison, H. L. M. *Examination, Boring and Valuation of Alluvial Deposits.* Mining Publications.
Proceedings of The Symposium of Open Cast Mining Quarrying and Alluvial Mining, London 1964.

(x) Oil and Natural Gas

Amyx, J. W., Bass, D. M. and Whiting, R. L. *Petroleum Reservoir Engineering.* Vols. I and II. McGraw-Hill.
Calhoun, J. C. *Fundamentals of Reservoir Engineering.* Univ. of Oklahoma Press, 1957.
Craft and Hawkins. *Applied Petroleum Engineering.* Prentice Hall, 1959.
Katz, J. *Handbook of Natural Gas Engineering.* McGraw-Hill, 1959.
Pirson, S. J. *Elements of Oil Reservoir Engineering.* McGraw-Hill.
Uren, L. C. *Petroleum Production Engineering.* Vol I, *Oil Field Exploitation;* Vol. II, *Development;* Vol. III, *Economics.* McGraw-Hill.

7.112 Mining Engineering II

Part 1. Sampling and valuation of mineral properties. Influence of impurities on recoveries, grades, markets. Management of mineral industry operations. Company law.

Part 2. Mine atmospheres, gas, dust, spontaneous combustion. Explosion, fires, safety, rescue and recovery. Mine ventilation, control of pressure, quantity and quality. Materials handling, loading transport and elevation of solids, transport of fluids, transport of men. Power supply and distribution. Drainage of mines, mine pump technology. Rock mechanics; support of mine openings. Strata control. Mine planning and design. Industrial report.

7.112/1 Mining Engineering II

For students in the B.Sc.(Tech.) course; based on topics selected from the syllabus of 7.112. The course is supplemented by a compulsory excursion of five days.

7.113 Mineral Industry Elective Project

Elective may include mineral process engineering; statistics; sampling and valuation; rock properties; mine and treatment plant design; petroleum production engineering; selected courses from other Schools. Students will be grouped in syndicates.

Text and Reference Books for 7.112, 7.113 and 7.112/1.

PRELIMINARY BACKGROUND READING

Blainey, G. *Mines in The Spinifex.* Angus and Robertson.
Hoover, H. C. *Principles of Mining.* McGraw-Hill.
Jenkin, A. K. H. *The Cornish Miner.* Allen and Unwin.
Rickard, T. A. *Man and Metals.* Vol. 1 and II. McGraw-Hill.
Rickard, T. A. *Technical Writing.* Wiley or A.I.M.E. Series.
Spalding, J. *Deep Mining.* Mining Publications Ltd.

TEXT BOOKS

Baxter, C. H. and Parks, R. D. *Examination and Valuation of a Mineral Property.* Addison-Wesley.
Orbert, L. and Duvall. W. *Rock Mechanics and the Design of Structure in Rock.* Wiley, 1967.
Roberts, A. *Mine Ventilation.* Cleaver Hume, 1960.
Standards Association of Australia. *Steel Wire Rope for Winding and Haulage Purposes in Mines.* As No. M/4—1955.

REFERENCE BOOKS

(i) Statistics

Arkin, H. and Colton, R. R. *Statistical Methods.* Barnes & Noble.
Schaifer, R. *Probability and Statistics for Business Decisions.* McGraw-Hill.
Walker, M. W. and Lev, J. *Statistical Inference.* Constable or Holt.

(ii) Hoisting

Broughton, H. H. *Electric Winders.* Spon.
Inst. of Mining and Metallurgy. *Wire Ropes in Mines.*
Price, A. G. *Winding Calculations for the Mining Engineer.* The General Electric Co.

(iii) Mine Ventilation

Barenburg, A. W. *Psychometry and Psychometric Charts.* South African Inst. of Mining and Metallurgy.
Buffalo Forge Co. *Fan Engineering.*
Bulletin 385, U.S. Bureau of Mines. Engineering Factors in the Ventilation of Metal Mines.
BSS 848. Testing of Fans.
Hartman, H. L. *Mine Ventilation and Air Conditioning.* Ronald Press, New York.
Penman, D. and J. S. *Principles and Practice of Mine Ventilation,* Griffin.
Rayner, H. E. R. *A Guide to Mine Ventilation Calculations.* Mine Ventilation Society of South Africa.
Transvaal Chamber of Mines. *Quality of Mine Air.*
Weeks, W. S. *Ventilation of Mines.* McGraw-Hill.

(iv) Economics

Chambers, R. J. *Financial Management.* Law Book Co.
Court, H. P. *Budgetary Control.* Sweet & Maxwell.
Brech, E. F. L. *Management, its Nature and Significance.* 3rd Edition. Pitman, 1953.
Dobb, M. *Wages.* Nisbet and C.U.P.
Hoover, T. J. *The Economics of Mining.* Standford, J.P. and O.U.P.
Myers, *Financial Statement Analysis.* Prentice-Hall.
Wilcox, F. *Mine Accounting and Financial Administration.* Pitman.

(v) Mining Law

Mining Acts. N.S.W., W.A., Tas., Qld., Vic. and S.A.
Ely, N. *Summary of Mining and Petroleum Laws of the World.* U.S. Bur. of Mines.

(vi) Safety Health

Davies, C. N. *Dust is Dangerous.* Faber and Faber.
Davies, R. N. *Breathing and Irrespirable Atmospheres.* St. Catherine Press.
Drinker, P. and Hatch, T. *Industrial Dust.* McGraw-Hill.
Gill, G. H. *Dust, its effects on the Respiratory System.* Lewis.
Inst. of Mining Engineers and Institution of Mining and Metallurgy, 1947. *Silicosis, Pneumoconiosis and Dust Suppression in Mines.*
Jenkins and Waltham. *Coal Mines Rescue and Fire Fighting.* C. Griffin, London.
McAdam, R. and Davidson, D. *Mine Rescue Work.* Oliver and Boyd.
Transvaal Chamber of Mines. *Safety Code.*

(vii) Mining Practice

Isaacson, E. de Q. St. *Rock Pressure in Mines.* Min. Pub. Ltd., 1962.
Jaeger, J. C. *Elasticity, Fracture and Flow.* Wiley, 1964.
Jeppe, C. B. *Gold Mining on the Witwatersrand.* Transvaal Chamber of Mines.
Mitke, C. A. *Mining Methods.* McGraw-Hill.
Peele, R. *Mining Engineers' Handbook.* Wiley.
Spruth Fritz. *Face Supports in Steel and Light Metal.* Colliery Guardian.
Statham, I. C. F. ed. *Coal Mining and Practice.* 4 vols. Caxton Publishing Co.
Tillson, B. F. *Mine Plant.* A.I.M.E.

(viii) General

Nelson, J. R. *Writing the Technical Report.* McGraw-Hill.

7.113-1 Mineral Industry Elective Project

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

7.121 Mine Surveying

General and special methods associated with the application of 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 surveys; special mine surveys; mine survey office organization.

7.121/1 Mine Surveying

For students in the B.Sc.(Tech.) course; based on the syllabus of 7.121.
Text and Reference Books for 7.121 and 7.121/1.

TEXT BOOKS

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

REFERENCE BOOKS

Haddock, M. *Deep Borehole Surveys and Problems.* McGraw-Hill.
Haddock, M. *The Basis of Mine Surveying.* Chapman and Hall.
Metcalfe, J. R. *Mining Engineers' Survey Manual.* Electrical Press.
Staley, W. *Introduction to Mine Surveying.* Stanford U.P.
Winiberg, F. *Metalliferous Mine Surveying.* Mining Publications.
Winiberg, F. *Surveying Calculations.* Mining Publications.

7.311 Mineral Processing I

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 system thickening, classification. Materials handling, automatic mill control, blending.

7.311/1 Mineral Processing I

For students in the B.Sc.(Tech.) course; based on the syllabus of 7.311. TEXT and REFERENCE BOOKS for 7.311 and 7.311/1.

TEXT BOOKS
Gaudin, A. M. *Principles of Mineral Dressing.* McGraw-Hill, *or*
Taggart, A. F. *Elements of Ore Dressing.* Wiley.

REFERENCE BOOKS
Brown, G. G. *Unit Operations.* Wiley.
Gaudin, A. M. *Flotation.* 2nd ed. McGraw-Hill.
Herdan, G. *Small Particle Statistics.* Butterworths.
Pryor, E. J. *An Introduction to Mineral Dressing.* Mining Publications.
Rose, H. E. and Sullivan, R. M. *Ball Tube and Rod Mills.* Constable.
Streeter, V. *Handbook of Fluid Dynamics.* McGraw-Hill.
Sutherland, K. and Wark, W. *Principles of Flotation.* Aust.I.M.M.
Taggart, A. F. *Handbook of Mineral Dressing.* Wiley.

7.312 Mineral Processing II

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

TEXT BOOKS
Gaudin, A. M. *Flotation.* 2nd ed. McGraw-Hill.
Taggart, A. F. *Handbook of Mineral Dressing.* Wiley.
Mitchell, D. R. *Coal Preparation.* A.I.M.E.
Cameron, E. N. *Ore Microscopy.* Wiley.

REFERENCE BOOKS
Fuerstenau, D. V. *Froth Flotation.* A.I.M.E.
Robie, E. *Economics of the Mineral Industries.* A.I.M.E.
Alexander, A. and Johnson, P. *Colloid Science.* O.U.P.
Pryor, E. J. *Economics for the Mineral Engineer.* Pergamon.
Short, M. W. *Microscopic Determination of the Ore Minerals.* U.S. Govt.
Uytenbogoardt, W. *Tables for Microscopy Identification of Ore Minerals.* U.S. Govt. Printing Office.
Burkin, A. *Chemistry of Hydrometallurgical Processes.* Spon.
Dennis. *Extractive Metallurgy.* Pitman.

7.551S Mining and Mineral Process Engineering

Part 1

Mining Engineering—An introduction to mining engineering. Principles of mine and quarry development. Mining extraction methods; selection of processes; application to coal, non-metallic and metalliferous deposits; petroleum production engineering. Mine sampling; grade calculations; valuation; ore reserves. Economics of the mineral industries. Mining and company law; management.

Part 2

Mineral Process Engineering—Comminution: liberation, size analysis, crushing and grinding. Concentrating processes: gravity, magnetic, electrostatic, froth flotation, chemical extraction. Process engineering; flowsheet and plant design. Materials handling; dewatering. Marketing of mineral products; evaluation of separation processes, smelter schedules.

Part 1

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

REFERENCE BOOKS
Bryson, T. *Mining Machinery*. Pitman.
Jackson, C. F. and Hedges, J. N. *Metal Mining Practice*. U.S. Bureau of Mines Bulletin, No. 419.
Sinclair, J. *Winning Coal*. Pitman.
Griffith, S. V. *Alluvial Prospecting and Mining*. Min. Pub.

Part 2
TEXT BOOK
Gaudin, A. M. *Principles of Mineral Dressing*. McGraw-Hill.

REFERENCE BOOKS
Baxter, C. H. and Parks, R. D. *Examination and Valuation of Mineral Property*. Addison-Wesley, 1957.
Gaudin, A. M. *Flotation*. McGraw-Hill.
Taggart, A. F. *Handbook of Mineral Dressing*. Wiley.

7.551/1 Mining and Mineral Process Engineering

For students in the B.Sc. (Tech.) Course. Based on the syllabus of 7.551.

MINERAL TECHNOLOGY GRADUATE SUBJECTS

7.391G Mineral Processing Technology

Microscope techniques; application to circuit design and operation. Gravity separation processes. electrostatic and magnetic separation. Surface chemistry of mineral particles, flotation and flocculation. Chemical processing and extraction. Process engineering, influence of mining methods on selection of beneficiation processes, flowsheet and plant design. Marketing of mineral products.

TEXT BOOKS
Cameron, E. N. *Ore Microscopy*. Wiley.
Gaudin, A. M. *Flotation*. 2nd ed. McGraw-Hill.
Mitchell, D. R. *Coal Preparation*. A.I.M.E.
Rose, H. E. and Sullivan, R. M. *Ball Tube and Rod Mills*. Constable.
Taggart, A. F. *Handbook of Mineral Dressing*. Wiley.

REFERENCE BOOKS
Alexander, A. and Johnson, P. *Colloid Science*. Oxford.
Baxter, C. H. and Parks, R. D. *Examination and Valuation of a Mineral Property*. Addison-Wesley.
Brown, G. G. *Unit Operations*. Wiley.
Burkin, A. *Chemistry of Hydrometallurgical Processes*. Spon.
Dorr, J. V. N. and Bosqui, F. L. *Cyanidation and Concentration of Gold and Silver Ores*. McGraw-Hill.
Feurstenau, D. W. *Froth Flotation*. A.I.M.E.
Herdan, G. *Small Particle Statistics*. Butterworth.
Pryor, E. J. *Economics for the Mineral Engineer*. Pergamon.
Robie, E. *Economics of the Mineral Industries*. A.I.M.E.
Schonten, C. *Determination Tables for Ore Microscopy*. Elsevier.
Short, M. W. *Microscopic Determination of the Ore Minerals*. U.S. Govt. Printing Office.
Sinclair, J. *Coal Preparation and Power Supply at Collieries*. Pitman.
Sutherland, K. and Wark, W. *Principles of Flotation*. Aust.I.M.M.
Uytenbogoardt, W. *Tables for Microscopy Identification of Ore Minerals*. U.S. Govt. Printing Office.

7.392G 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.

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

REFERENCE BOOKS
Michell, F. B. *The Practice of Mineral Dressing.* Elect. Press.
Modern Mineral Processing Flowsheets. Denver Equipment Co.
Handbook on Belt Conveyor Design. G.E.C.
Rabone, P. *Flotation Plant Practice.* Mining Publications

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.

TEXT BOOKS
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.

REFERENCE BOOKS
Isaacson, E. *Rock Pressures in Mines.* Mining Publications.
Roberts, A. *Mine Ventilation.* Cleaver Hume.
Sanders, R. *Project Plowshare.* Public Affairs Press., Washington.
Sinclair, J. *Winning Coal.* Pitman.

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.

TEXT BOOKS
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.

TEXT BOOKS
As for 7.191G. Mining Engineering.

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.

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.

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.

Reference Books for 13.111, 13.112 and 13.113

(1) Textile Testing

Technical Manual Test Methods. Amer. Assoc. of Textile Chemists and Colourists, Durham, 1966.

Standards. Vols. 24 and 25. American Society for Testing and Materials, Philadelphia, 1967.

Textile Standards. The Standard Assocn. of Australia, Sydney.

Booth, J. E. *Principles of Textile Testing.* National Trade Press, London, 1961.

Brearley, A. and Cox, D. *An Outline of Statistical Methods for Use in the Textile Industry.* WIRA, Leeds, 1956.

British Standards Handbook. Methods of Test for Textiles. Brit. Standard Institution. London, 1963.

Garner, J. W. *A Textile Laboratory Manual.* National Trade Press. London, 1951.

Grover, E. B. and Hamby, D. S. *Handbook of Textile Testing and Quality Control.* Textile Book Publishers. N.Y., 1960.

Hearle, J. W. S. and Peters, R. H. *Moisture in Textiles.* Manchester Textile Institute. Butterworth, 1960.

Howell, H. G., Mieszkig, K. W. and Taber, D. *Friction in Textiles.* Butterworth's Scientific Publications, 1959.

Kaswell, E. R. *Textile Fibres, Yarns and Fabrics.* Reinhold, 1953.

Koch, P. *Microscopic and Chemical Testing of Textiles.* Chapman & Hall, 1963.

Luniak, B. *Identification of Textile Fibres.* Pitman, 1953.

Meredith, R. and Hearle, J. W. S. *Physical Methods of Investigating Textiles.* N.Y. Textile Book Publishers, 1959.

Morton, W. E. and Hearle, J. W. S. *Physical Properties of Textile Fibres.* Manchester Textile Institute, 1962.

Preston, J. M. *Fibre Science.* Manchester Textile Institute, 1953.

Manual of Cotton Spinning. The Characteristics of Raw Cotton. Vol. 2. Part 1. The Textile Institute, Manchester, 1955.

Identification of Textile Materials. The Textile Institute, Manchester, 1965.

Physical Properties of Wool Fibres and Fabrics. Vol. 2, WIRA, Leeds.

Testing and Control in the Wool Industry. Vol. 3. WIRA, Leeds.

(2) Raw Materials

Carrol-Porczynski, C. Z. *Manual of Man-made Fibres.* Astex, Guildford, 1960.

Cook, J. Gordon. *Handbook of Textile Fibres.* 3rd ed. Merrow, Watford, 1964.

Harris, M. *Handbook of Textile Fibres.* Harris Research Lab., Washington. D.C., 1954.

Lord, E. *Manual of Cotton Spinning.* Vol. 1 (Cotton Raw Material). The Textile Institute.

McFarlane, S. B. ed. *Technology of Synthetic Fibres.* Fairchild, N.Y.. 1953.

Matthews, J. M. *Textile Fibres.* Wiley, N.Y., 1947.

Moncrieff, R. W. *Man-made Fibres.* 3rd ed., National, London, 1957.

Onions, W. J. *Wool—An Introduction to its Properties, Varieties, Uses and Production.* Benn, London, 1962.

Press, J. J. ed. *The Man-made Textile Encyclopaedia.* Intersci. N.Y.

American Cotton Handbook.

van Bergen, W. *Wool Handbook.* Vol. 1. 3rd ed. Intersci. N.Y., 1963.

Wormell, R. L. *New Fibres from Proteins.* Butterworth, 1954.

(3) Dyeing and Finishing

Bird, C. L. *The Theory and Practice of Wool Dyeing.* Soc. Dyers and Colourists. Bradford.
Giles, C. H. *Laboratory Course in Dyeing.* Soc. Dyers and Colourists. Bradford, 1957.
Marsh, J. T. *Introduction to Textile Bleaching.* Chapman & Hall, London.
Marsh, J. T. *Introduction to Textile Finishing.* Chapman & Hall, London, 1966.
Marsh, J. T. *Mercerising.* Chapman & Hall, London.
Marsh, J. T. *Self Smoothing Fabrics.* Chapman & Hall, London, 1962.
Moilliet, J. L., Collie, B. and Black, W. *Surface Activity.* Spon. London, 1961.
Schmidlin, H. U. *Preparation and Dyeing of Synthetic Fibres.* Chapman & Hall, London, 1963.
Schwarz, A. M. and Perry, J. W. *Surface-Active Agents.* Interscience, 1958.
Colour Index. Soc. Dyers and Colourists.
Vickerstaff, T. *The Physical Chemistry of Dyeing.* Oliver & Boyd. London, 1954.

(4) Knitting

Chamberlain, J. *Knitting Mathematics and Mechanisms.* City of Leicester, College of Technology and Commerce, 1952.
Chamberlain, J. *Principles of Machine Knitting.* Textile Institute, Manchester, 1951.
Mills, R. W. *Fully Fashioned Garment Manufacture.* Cassell, London, 1965.
Paling, D. *Warp Knitting Technology.* 2nd ed. Columbine Press, Manchester, 1965.
Reichman, C. ed. *Advanced Knitting Principles.* N.K.O.A., N.Y., 1964.
Reichman, C. ed. *Principles of Knitting Outerwear Fabrics and Garments.* N.K.O.A., N.Y., 1961.
Reisfeld, A. *Warp Knit Engineering.* N.K.O.A., N.Y., 1966.
Shinn, W. *Principles of Knitting.* Vols. I and II. Clark. Charlotte, N.C., 1957.
Wignall, H. *Knitting.* Pitman, London, 1964.

(5) Weaving

Aitken, J. B. *Automatic Weaving.* Columbine Press, 1964.
Bennett, G. A. *Introduction to Automatic Weaving.* Harlequin, 1948.
Crossland, A. *Modern Carpet Manufacture.* Columbine Press, 1958.
Duxbury, V. and Wray, G. R. *Modern Developments in Weaving Machinery.* Columbine Press, 1962.
Middlebrook, W. *Primary Aspects of the Power Loom.* Emmott, 1953.
Middlebrook, W. *Secondary Aspects of the Power Loom.* Emmott, 1956.
Robinson, A. T. C. *Rayon Fabric Construction.* Skinner, 1951.
Robinson, A. T. C. *Woven Cloth Construction.* Butterworths, London, 1967.
Seydel, P. V. *Warp Sizing.* W. R. Smith, 1958.
Watson, W. *Advanced Textile Design,* 3rd ed. Longmans, 1955.
Watson, W. *Textile Design and Colour.* 6th ed. Longmans, 1954.
Wright, R. W. *Modern Textile Design and Production.* Nat. Trade Press. 1949.

(6) Yarn Manufacture

Caldwell. *Rayon Staple Fibre Spinning.*
Griffin, T. F. *Practical Worsted Carding.* Nat. Trade Press, London, 1957.
Griffin, T. F. *Practical Worsted Combing.* Nat. Trade Press, London, 1957.
Morton. *Introduction to the Study of Spinning.*

Nissan, A. H. *Textile Engineering Processes.* Butterworth, London, 1959.
Radcliffe. *Woollen and Worsted Yarn Manufacture.*
Manual of Cotton Spinning. Vol. II, Part 2. *Opening and Cleaning.* 1963. Vol. III, *Carding.* 1965. Vol. IV, Part 1. *The Principle of Roller Drafting.* 1964. Vol. IV, Part 2. *Drawframes, Combers and Speedframes.* 1964. Vol. V. *The Principles and Theory of Ring Spinning.* 1965. Text. Institute and Butterworth. Manchester.
Walker. *Worsted Drawing and Spinning.* Part 1, *Drawing.*
Wool Research. Vol. 4. *Carding.* Vol. 6. *Drawing and Spinning.* W.I.R.A., Leeds, 1948.
Wray, G. R. *Modern Yarn Production from Man-made Fibres.*

13.211 Textile Science I

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

13.212 Textile Science II

Fibres, rubbers and plastics. Polymerization. Chemical constitution and reactivity of the natural and man-made fibres. Morphological structure of fibres; optical and electron microscopy, X-ray diffraction and infra-red spectroscopy.

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.

REFERENCE BOOKS for 13.211, 13.212 and 13.213.

(1) Textile Chemistry

Alexander, Hudson and Earland. *Wool: Its Chemistry and Physics.* Chapman & Hall, London, 1954.
Hearle and Peters. *Fibre Structure.* Textile Institute, Manchester, 1963.
Hill. *Fibres from Synthetic Polymers.* Elsevier, Amsterdam. 1953.
Judd and Wyszecki. *Colour in Business, Science and Industry.* 2nd ed. John Wiley, N.Y., 1963.
Moore. *An Introduction to Polymer Chemistry.* U.P., London, 1963.
Optical Society of America. *The Science of Colour.* Thom. Y. Crowell Co., N.Y., 1953.
Ott and Spurlin. *Cellulose. High Polymers.* Vol. V, II. Interscience, N.Y.
Peters, R. H. *Textile Chemistry.* Vol. I. Elsevier, Amsterdam, 1963.
Review of Textile Progress. Annual. The Textile Institute and Soc. of Dyers and Colourists.
Ward. *Chemistry and Chemical Technology of Cotton.* Interscience, N.Y., 1955.
Wright, W. D. *Measurement of Colour.* 3rd ed. Hilger & Watts, London, 1964.

(2) Textile Physics

Alexander, P. and Hudson, R. F. *Wool: Its Chemistry and Physics.* Chapman & Hall, London. 2nd ed., 1963.
Astbury, W. T. *Fundamentals of Fibre Structure.* Oxford, 1933.
Astbury, W. T. *Textile Fibres under the X-rays.* I.C.I. Ltd.
Barrow, G. M. *The Structure of Molecules.* Benjamin, N.Y., 1964.
Bennett, Jupnik, Osterberg and Richards. *Phase Microscopy: Principles and Applications.* Wiley, N.Y., 1951.
Crank, J. and Park, G. S. *Diffusion in Polymers.* Academic. London, 1968.
Eirich. *Rheology.* Vols. I and II. Academic, N.Y., 1956.
Frey-Wyssling, A. *Submicroscopic Morphology of Protoplasm and its Derivatives.* Elsevier, Amsterdam, 1948.
Guinier. *X-ray Crystallographic Technology.*
Hearle, J. W. S. and Peters, R. H. eds. *Fibre Structure.* Butterworth (Textile Institute), Manchester, 1963.
Hearle, J. W. S. and Peters, R. H. *Moisture in Textiles* .
Hermans, P. H. *Physics and Chemistry of Cellulose Fibres.* Elsevier Amsterdam, 1949.
Heyn, A. N. J. *Fibre Microscopy.* Interscience, N.Y., 1954.
Hill, R. ed. *Fibres from Synthetic Polymers.* Elsevier, Amsterdam, 1953.
Howell, Mieszkis and Tabor. *Friction in Textiles.* Butterworth, London, 1959.
Kaswell, E. R. *Textile Fibres, Yarns and Fabrics.* Reinhold, N.Y., 1953.
Meredith, R. *Mechanical Properties of Textile Fibres.* North-Holland, Amsterdam, 1956.
Meredith, R. and Hearle, J. W. S. eds. *Physical Methods of Investigating Textiles.* Interscience, N.Y., 1959.
Morton, W. E. and Hearle, J. W. S. eds. *Physical Properties of Textile Fibres.* Butterworth (Textile Institute), Manchester, 1962.
Oster, G. and Pollister, A. W. *Physical Techniques in Biological Research.* Vols. I and II. Academic, N.Y., 1955.
Preston. J. M. ed. *Fibre Science.* Textile Institute, Manchester, 1953.
Stoves, J. L. *Fibre Microscopy.* National, London, 1957.
Urquhart, A. R. and Howitt, F. O. *The Structure of Textile Fibres: An Introductory Study.* The Textile Insttiute, Manchester, 1953.
Varian Associates. *NMR and EPR Spectroscopy.* Pergamon, Oxford. 1960.
Wheatley. P. J. *The Determination of Molecular Structure.* 2nd ed. Oxford, 1968.
Woods, H. J. *Physics of Fibres.* Inst. of Physics, London. 1955.
Physical Properties of Wool Fibres and Fabrics. Wool Research, Vol. 2. Wool Industries Research Association.
Zemansky. *Heat and Thermodynamics.* McGraw-Hill, N.Y., 1957.
Bowden and Tabor. *Friction and Lubrication of Solids.* Vol. 1. Oxford, 1954.
Bowden and Tabor. *Friction and Lubrication.* Methuen, London. 1956.

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.

REFERENCE BOOKS for 13.311 and 13.312
Clifford, A. E. Textile Organisation and Production. Carter, Belfast, 1951.
Cook, A. L. and Carr, C. C. *Elements of Electrical Engineering.* Wiley, N.Y., 1949.
Eckman, D. P. *Industrial Instrumentation.* Wiley, N.Y., 1950.
Enrich, N. L. *Industrial Engineering Manual for Textile Industry.* Textile Book Pub., N.Y., 1962.
Greenhut, M. L. *Plant Location in Theory and Practice.* Uni. of N.C. Press, Chapel Hill, 1956.
The Efficient Use of Fuel. Her Majesty's Stationery Office, London, 1958.
Illumination Engineering Soc. Lighting Handbook. The Illumination Engineering Soc. N.Y., 1959.
Kent. Mechanical Engineers' Handbook. Power. Vol. I. Wiley, N.Y., 1964.
Kent. Mechanical Engineers' Handbook. Design and Production. Wiley, N.Y., 1964.
Kern, D. Q. *Process Heat Transfer.* McGraw-Hill, N.Y., 1950.
Lyle, O. *The Efficient Use of Steam.* Her Majesty's Stationery Office, London, 1960.
Michell, A. G. M. *Lubrication: Its Principles and Practice.* Blackie, London, 1950.
Staniar, W. ed. *Plant Engineers' Handbook.* 2nd ed. McGraw-Hill, N.Y., 1959.
Swale, W. E. *Electricity in Textile Industry.* National Trade Press, London, 1956.
Wrangham, D. A. *The Theory and Practice of Heat Engines.* 2nd ed. Cambridge U.P., 1948.
Young, A. F. *An Introduction to Process Control System Design.* Longmans, London, 1957.

SCHOOL OF WOOL AND PASTORAL SCIENCES

9.101 Livestock Production I

Anatomy, histology and introduction to the physiology of the domestic animals. Mammalian evolution and embryology.

The livestock industry and its place in the economic life of Australia. Production of livestock products and trends. The inter-relationships of the various classes of stock and the natural, economic and artificial conditions determining the stratification of types. Breeds of livestock of importance to the pastoral industry and aids to judging. Breeds of sheep, their uses and economic relationships. Sheep management and calendar of operations. Flock composition; principal sources of loss and their control.

9.122 Livestock Production II

The more important breeds of beef cattle, dairy cattle, pigs, working dogs, and their management. Production of beef, veal, pigmeats, milk and milk products, and quality concepts. Handling hides and skins. Stud breeding—record keeping.

Livestock husbandry in relation to diseases. The Stock Diseases Act. Types of disease, immunity. Bacteriology and pathology. Parasitology—external and internal parasites. Diseases of the fleece, deficiency diseases. Poison plants. Specific diseases. Commoner diseases of cattle, horses, pigs and dogs. Veterinary first-aid. Common drugs.

9.123 Livestock Production III

Principles of livestock production and their application in animal industry; reproduction and fertility; milk secretion; growth and development; nutrition

and breeding. Crossbreeding. Prime lamb production. Factors affecting livestock production, e.g., pasture improvement.

Text and Reference Books for 9.101, 9.122 and 9.123.

TEXT BOOKS

Ashton, A. *Dairy Farming in Australia.* N.S.W. ed. Dept. Commerce and Industry, 1967.
Belschner, H. E. *Sheep Management and Diseases.* 7th ed. A. & R. 1965.
Cole, V. C. *Sheep Management for Wool Production.* Grazcos, Sydney, 1963.
Hammond, edited by. *Progress in the Physiology of Farm Animals.* 3 vols. Butterworth, 1956.

REFERENCE BOOKS

Allee, W. C. et al. *Principles of Animal Ecology.* Saunders.
Science of Meat and Meat Products. American Meat Inst. Foundation. Freeman, 1960.
Techniques and Procedures in Animal Production Research. American Society of Animal Production.
Beattie, W. A. *Beef Cattle Breeding and Management.* Past. Rev.
Beattie, W. A. *Beef Cattle Industry of Australia.* CSIRO Bull. No. 278.
Brody, S. *Bioenergetics and Growth.*
Belschner, H. G. *Cattle Diseases.* 1967.
Belschner, H. G. *Pig Diseases.*
Butterfield, R. M. and May, N. D. S. *Muscles of the Ox.* U.Q.P.
Charleton, H. M. and Leach, E. H. *Schafer's Essentials of Histology.* Longmans.
Cole, H. H. and Cupps, P. T. *Reproduction in the Domestic Animals,* 2 vols. Academic.
Downey, L. A. *Pig Raising.* 2nd ed. A. & R.
Drabble, J. *Textbook of Meat Inspection.* A. & R.
Dukes. *Physiology of Domestic Animals.* Bailliere, 1955.
Folley, S. J. *Physiology and Biochemistry of Lactation.* Oliver & Boyd.
Foust, H. L. and Getty, R. *Anatomy of Domestic Animals.* Iowa University Press, 1960.
Frandson, R. D. *Anatomy and Physiology of Farm Animals.* Lea & Fiebeger, 1962.
Fraser, A. *Beef Cattle Husbandry.* Crosby Lockwood.
Fraser, A. and Stamp, J. T. *Sheep Husbandry and Disease.* Crosby Lockwood.
Hafez, E. S. E. *Reproduction in Farm Animals.* Lea and Fiebiger, 1962.
Hammond, J. ed. *Farm Animals.* Arnold, 1960.
Hammond, J. *Growth and Development of Mutton Qualities of Sheep.* Oliver & Boyd, 1932.
Kelley, R. B. *Sheep Dogs (Breeding Care and Management).* A. & R.
Kent, G. C. *Comparative Anatomy of the Vertebrates.* McGraw-Hill.
McGregor, J. G. *Structure of Meat Animals.*
McMeekan, C. P. et al. *Principles of Animal Production.* Whitcombe & Tombs, 1960.
May, N. D. S. *Anatomy of the Sheep.* U.Q.P.
Miller, W. C. and West, G. P. *Encyclopaedia of Animal Care.* A. & C. Black.
Nicholls, J. E. *Livestock Improvement in Relation to Heredity and Environment.* Oliver & Boyd.
O'Loughlin, F. ed. *Beef Cattle in Australia.* Country Life Newspaper.
Parkes, A. S. *Marshall's Physiology of Reproduction, Parts I and II.* Longmans.
Patten, B. M. *Foundations of Embryology.* McGraw-Hill.
Pearse, E. H. *Sheep Farm and Station Management.* Past. Rev.

Phillips, R. W. *Breeding Animals Suited to Unfavourable Environments.* FAO.
Roberts, D. S. *Insects Affecting Livestock.*
Robinson, T. J. *Control of the Ovarian Cycle in Sheep.* Syd. U.P.
Sisson, S. and Grossman, J. D. *Anatomy of Domestic Animals.* Saunders.
Snapp, R. R. *Beef Cattle.*
Spedding, C. R. W. *Sheep Production and Grazing Management.* Bailliere, Tindale & Cox, 1965.
Sutherland, J. A. *Understanding Farm Animals.* A. & R.
Taylor, J. *Regional and Applied Anatomy of Domestic Animals.*
Thomas, J. F. et al. *Sheep.*
Trautmann, J. and Fiebiger, J. F. *Fundamentals of the Histology of Domestic Animals.*
Tribe, D. E. and Coles, G. J. R. *Prime Lamb Production.* Cheshire.
Trow-Smith, R. *History of the British Livestock Industry.* 2 vols. Standish.
Turner, C. W. *Anatomy of the Udder.* Columbia.
Waddington, C. H. *Principles of Embryology.* Allen & Unwin.
Yeates, N. T. M. *Modern Aspects of Livestock Production.* Butterworth, 1965.

9.131 Ruminant Parasite Ecology

Classification, morphology, metabolism, host-parasite relationships and modes of infestation of parasites. Detailed studies of the gastro-intestinal nematodes of sheep and cattle; their identification, life cycle, distribution and pathogenesis, nematodes of the respiratory system, trematodes and cestodes of sheep and cattle and other internal parasites. Host-parasite-environment relationships including preparasitic stages and ecology of free-living stages, resistance and immunity and control.

The distribution, life cycles, pathogenesis, recognition, treatment and control of the external parasites of sheep and cattle.

Practical aspects of the course will include techniques for total differential worm counts, identification of the various parasites, diagnostic techniques and collection of material; culture and identification of larvae.

REFERENCE BOOKS

Soulsby, E. J. L. *Textbook of Veterinary Clinical Parasitology.* Vol. I. *Helminths,* Blackwell Scientific Publications. Oxford.
Crofton, H. D. *Nematode Parasite Populations in Sheep and on Pasture.* Comm. Bur. Helminth. Tech. Comm. No. 35.
Whitlock, J. H. *Diagnosis of Veterinary Parasitisms.* Lea & Febiger.
Lee, D. L. *The Physiology of Nematodes.* Oliver & Boyd, London.
Lapage, G. *Monning's Veterinary Helminthology and Epidemiology.* Balliere, Tindall and Cox, London.

9.221 Agronomy

Agricultural climatology, soil science, and soil conservation. Pastures in land use and land development. Principles of tillage, crop production, irrigation and fertilizer use. Weeds and weed control. Practical work in the systematics of plant families.

9.231 Pastoral Agronomy

Pasture ecology. Establishment, management and utilization of pastures. Fodder and field crops associated with the sheep industry. Fodder conservation. Insect pests of pastures.

TEXT BOOKS for 9.221 and 9.231.

Barnard, C. *Grasses and Grassland.* Macmillan.
Black, J. N. *Flora of South Australia.* (Parts I-IV). S. Aust. Govt. Printer.

Burbridge. *Australian Grasses.* A. & R.
CSIRO. *The Australian Environment.* Angus & Robertson.
Donahue, R. L. *Soils.* Prentice-Hall.
Leeper, C. W. *Introduction to Soil Science.* Melb. Univ. Press.
Molnar, I. *Manual of Australian Agriculture.* Heineman.
Whittet, J. N. *Weeds.* N.S.W. Dept. of Agriculture.
Whittet, J. N. *Pastures.* N.S.W. Dept. of Agriculture.

9.311 Economics

Economic Theory—The main divisions of economic theory and the basic concepts in production economic analysis: factor/product, factor/factor and product/product relationships. The nature of costs and cost analysis. Returns to scale. Planning under imperfect knowledge. Wool futures, the operation of the Australian monetary system.

Wool in Australian Economy—Australian economic growth 1788-1860; 1860-1900 and after 1900. Economic organization of the pastoral industry. The wool market at home and overseas and future prospects.

Introduction to Farm Management—Its meaning, objectives and scope in different environments.

9.312 Farm Management

Land utilization in relation to farm management; climatic influences; patterns of enterprise distribution, land valuation and improvements; farm size and layout; labour and rural credit. Yield and intensity in production. Financial and production records and accounts; inventory theory; tests of economic efficiency. Farm planning and organization. Budgeting and programming. Gross margin analysis. Linear programming. Economics of pasture improvement, fertilizer use, drought and fodder conservation and irrigation.

Text and Reference Books for 9.311 and 9.312.

TEXT BOOKS

Castle, E. N. and Becker, M. H. *Farm Business Management.* Macmillan.
Heady, E. O. *Economics of Agricultural Production and Resource Use.* Prentice Hall.

REFERENCE BOOKS

The Farm as a Business. Agriculture, Fish and Food Ministry. H.M.S.O.
Barnard, A. *Growth of the Australian Wool Market, 1840-1900.* Melbourne U.P.
Black, J. D. *Introduction to Economics for Agriculture.* Macmillan.
Blagburn, C. H. *Farm Planning and Management.* Longmans.
Emery, F. E. and Oeser, O. A. *Information, Decision and Action.* Melbourne U.P.
Heady, E. O. and Candler, W. *Linear Programming Methods.* Iowa State College Press.
Heady, E. O. and Dillon, J. L. *Agricultural Production Functions.* Iowa State College Press.
Heady, E. O. and Jensen, H. A. *Farm Management Economics.* Prentice-Hall.
Hopkins, J. A. and Heady, E. O. *Farm Records and Accounting.* Iowa State College Press.
King, C. *Outline of Closer Settlement in New South Wales.* Govt. Printer.
Mallyon, C. A. *Principles and Practice of Farm Management Accounting.* Law Book Co.
Accounting and Planning for Farm Management. Queensland Department of Primary Industry. Pole & Co., 1966.
Wadham, S. and Wood, J. *Land Utilisation in Australia.* Melbourne U.P.

Yang, W. Y. *Methods of Farm Management Investigations.* FAO Agricultural Development Paper No. 64.

9.411 Agricultural Chemistry

The chemistry of feeding stuffs. Proximate analysis. Growth changes. Isolation, examination and estimation of constituents. Vitamins and assessment of nutritional value. Chemistry of silage. Correlations of structure and properties. Animal milks, factors affecting composition.

Poisonous plants. Agricultural chemicals. Water supplies (stability, activities of enzymes, substrate requirements).

General principles of analytical methods. Trace metal analysis. Colorimetry and instrumental techniques.

Concurrent extensions in chemistry as necessary.

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.

TEXT BOOKS

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.

REFERENCE BOOKS

Annison, F. and Lewis, D. *Metabolism in the Ruminant.* Methuen, 1959.
Blaxter, K. L. *Energy Metabolism of the Ruminants.* 1st ed. Hutchinson, London, 1962.
Rations for Livestock. British Ministry of Agriculture. H.M.S.O. Bull. No. 48, 1948.
Halnan and Garner. *Principles and Practice of Feeding Animals.* 5th ed. Estates Gazette, 1966.
Ivins, J. D. *Measurement of Grassland Productivity.* Butterworth, 1959.
Lewis, D. *Digestive Physiology and Nutrition of the Ruminant.* Butterworth, 1960.
Morrison, F. B. *Feeds and Feeding.* 21st ed. Henry Morrison, 1949.
Recommended Nutrient Allowances for Domestic Animals. National Research Council (U.S.A.), 1959.
Proc. 7th International Congress Animal Husbandry, Madrid, 1956.
Proc. 16th International Vet. Congress, Madrid, 1959.
Sheehy, E. J. *Animal Nutrition.* Macmillan, 1955.
Underwood, E. J. *Trace Elements in Human and Animal Nutrition.* Academic, 2nd ed., 1962.

9.531 Wool Technology I

Wool Biology—Structure and function of skin. Aspects of fibril formation. Structure of follicles. The hair growth cycle. Development of fibre population in sheep. Comparative fleece biology.

Wool Metrology—All common measurement techniques, yield, length, diameter, damage, fleece components, their estimation and analysis of results.

Raw Materials—This subject, taught by the School of Textile Technology, constitutes part (*a*) of 13.511 General Textiles. A course on origin, chemical composition, structure and properties of natural and synthetic fibres, with particular emphasis on comparative properties.

Wool—Fleece characteristics—fibre fineness, crimp and quality number, staple length, soundness, colour and yield. Component parts of the fleece. The wool product of Merino, British and Australasian breeds. Wool defects and discolorations. Vegetable fault in relation to district, price and processing. Theory of wool classing, shearing shed procedure, practical wool sorting, classing and typing.

9.532 Wool Technology II

Wool Textile Manufacture—Taught by the School of Textile Technology; constitutes part (*a*) of 13.512 General Textiles.

Detailed instruction on function of machines involved in woollen and worsted processing from scouring to (and including) finishing. The function and general mechanism of each stage of processing are studied and comparisons are made with other types of manufacture where possible.

Wool—Carbonizing and fellmongering. Central classing and repacking. Preparation of the wool selling brokers' catalogue. Wool buying techniques, wool shipment and finance. Composition and functions of the Australian Wool Board and International Wool Secretariat. A.W.B. Table of Types and Descriptions, history and application. Carpet wool. Wool top appraisal. Wool production and marketing in overseas countries. Wool futures. Practical wool sorting, classing and typing.

The following trade visits will be undertaken during Wool Technology I and II at times coincident with relevant theory and practice: worsted manufacture, woollen manufacture, scouring and carbonizing, fellmongering, carpet manufacture, repacking houses, wool brokers' stores, wool saleroom.

9.533 Wool Technology III

Wool types, appraisal of wool samples in terms of Australian Wool Board type, quality and yield.

9.534 Wool Technology IV

Wool Fibre Science—Histology of the fibre; molecular structure; chemical composition; mechanical properties; chemical reactivity; technology.

Text and Reference Books for 9.531, 9.532, 9.533 and 9.534.

TEXT BOOKS

Henderson, A. E. *Growing Better Wool.* A. H. & A. W. Reed.
Onions, W. J. *Wool.* Benn, 1961.

REFERENCE BOOKS

Anderson. R. *On the Sheep's Back.* Sun Books, Melbourne.
Austen, H. B. *The Merino. Past, Present and Probable.* A. & R.
Barnard, A. *The Simple Fleece.* A.N.U.
Barnard, A. *Growth of the Australian Wool Market, 1840-1900.* Melbourne U.P.
Bennett, G. A. *Introduction to Automatic Weaving.* Harlequin, 1948.
Bird, C. L. *The Theory and Practice of Wool Dyeing.* 3rd ed. Soc. Dyers & Colourists, Bradford, 1963.
Bowen, G. *Wool Away.*
British Wool Manual.
Bradbury. *Calculations in Yarns and Fabrics.*

Burgess et al. *Mechanical Properties of Textile Fibres.* North Holland Publishing Co.
C.I.B.A. *The Wool Fibre.* Review No. 113. C.I.B.A.
Fegan, J. M. *Merino Wool.* Grahame.
Guthrie, J. F. *A World History of Sheep and Wool.* Pastoral Review.
Henderson, A. E. *Wool and Wool Classing.* Halstead.
Identification of Textile Materials. Textile Institute, Manchester, 1965.
Luniak, A. *Identification of Textile Fibres.* Pitman.
Lyne, A. G. and Short, B. F. *Biology of the Skin and Hair Growth.*
Marsh, J. T. *Introduction to Textile Finishing.* Chapman & Hall, London, 1966.
Matthews, J. M. *Textile Fibres.* Wiley, N.Y., 1947.
Methods of Test for Textiles. B. S. Handbook. B.S.I. London, 1963.
Meredith, R. *The Mechanical Properties of Textile Fibres.*
Moncrieff, R. W. *Man-made Fibres.* 3rd ed. National, London, 1957.
Morton. *Introduction to the Study of Spinning.*
Preston, J. M. *Fibre Science.* Textile Inst.
Proceedings of the International Wool Textile Res. Conf. Aust., 1955.
Radcliffe. *Woollen and Worsted Yarn Manufacture.*
Ryan, L. D. *Sheep Shearing Experting.* A. & R.
Stoves, J. L. *Fibre Microscopy.* Heywood & Co.
Reviews of Textile Progress. Textile Institute and Society of Dyers & Colourists.
Truter, E. V. *Wool Wax.* Cleaver-Hume.
Urquhart, A. R. and Howitt, F. O. *Structure of Textile Fibres.* Textile Inst.
von Bergen, J. P. *American Wool Handbook.*
Wildman, A. B. *Microscopy of Animal Textile Fibres.* W.I.R.A.
Woods, H. J. *Physics of Fibres.* Inst. Physics.
Wool Science Reviews. I.W.S.

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

Mammalian physiology directed towards domestic livestock production and homeostatic mechanics. Emphasis will be placed upon technique.

Active transport and allied membane phenomena. Co-ordinator systems (neural, humoral), reproduction and lactation. Development physiology. General metabolism and its regulation—the physiology and metabolism of specific organs—heart, muscle, liver, kidney. The physiology of the mammalian digestive tract. Environmental physiology—adaptive mechanisms—especially in the newborn, and in heat tolerance; the immune reaction. Electrolyte physiology—acid-base equilibrium of the organism; use of clearance values in measuring renal and liver activity—respiration—techniques of gas analysis and respirometry. Circulation, cardiac output and distribution (experimental techniques), special vascular circuits (pulmonary, cerebral, hepatic, splenic, renal, testicular). Physiology of the skin.

Text and Reference Books for 9.601 and 9.602.

TEXT BOOK

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

REFERENCE BOOKS

Best, C. H. and Taylor, N. B. *Physiological Basis of Medical Practice*. 8th ed. Williams & Wilkins, 1966.

Benzie, D. and Phillipson, A. *The Alimentary Tract of the Ruminant*. Oliver & Boyd, 1957.

Brachet, J. *Biochemical Cytology*. Academic, 1957.

Dukes, H. H. *Physiology of Domestic Animals*. 7th ed. Bailliere, 1955.

Fulton, J. F. *Textbook of Physiology*. 17th ed. Saunders, 1955.

Hall, P. F. *The Functions of the Endocrine Glands*. Horwitz, 1957.

Hammond, Sir J. ed. *Progress in the Physiology of Farm Animals*. 3 vols. Butterworth, 1954-9.

Harris, S. G. and Donovan, E. T. eds. *The Pituitary Gland*. 3 vols. Butterworth, 1966.

Hawker, R. W. *Synopsis of Endocrinology*. Brooks, 1950.

Maximow, V. and Bloom, W. *A Textbook of Histology*. Saunders, 1957.

Prosser, C. L. and Brown, D. W. *Comparative Animal Physiology*. Saunders, 1962.

Short. *The Bio-synthesis and Secretion of Adrenal Steroids*.

Spector, H. *Handbook of Biological Data*. Saunders, 1956.

Szenthagothai, J. et al. *Hypothalamic Control of the Anterior Pituitary*. Akademiai Kiado, 1962.

9.801 Genetics I

Applied genetics in relation to sheep and other farm livestock. Mendelian inheritance. Chromosomes, linkage and the physical basis of heredity. Gene action in physiology, development and sex determination. Mutation. Principles of statistical genetics, strength of inheritance, selection, interrelationships, genetics and 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.

Text and Reference Books for 9.801 and 9.802.

TEXT BOOKS

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

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

REFERENCE BOOKS

Allaid, R. A. *Principles of Plant Breeding*. Wiley, 1960.

Bogart, R. A. *Improvement of Livestock*. Macmillan, 1959.

Brink, R. A. ed. *Heritage from Mendel*. Wisconsin U.P.

Fisher, R. A. *Theory of Inbreeding*. Oliver & Boyd, 1949.

Hagedoorn, A. *Animal Breeding*. 6th ed. Crosby Lockwood, 1962.

Johansson, I. *Genetic Aspects of Dairy Cattle Breeding*. Oliver & Boyd, 1962.

Kempthorne, O. *Introduction to Genetic Statistics*. Wiley, 1957.

Lerner, I. M. *Population Genetics and Animal Improvement*. Cambridge, 1950.

Lerner, I. M. and Donald, H. P. *Modern Developments in Animal Breeding.* Academic, 1966.
Li, C. C. *Population Genetics.* Chicago, 1955.
Lush, J. L. *Animal Breeding Plans.* 3rd ed. Iowa, 1945.
Snedecor, G. W. *Statistical Methods.* 5th ed. Iowa, 1956.
Spiess, E. B. ed. *Papers on Animal Population Genetics.* Methuen, 1964.
Srb. A. M., Owen, R. D. and Edgar, L. S. *General Genetics.* 2nd ed. Freeman, 1965 .
Turner, H. N. and Young, S. S. Y. *Sheep Breeding.* Macmillan.
Waddington, C. H. *Strategy of the Genes.* Allen and Unwin, 1957.

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.

TEXT BOOK

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

REFERENCE BOOKS

Cochran, W. G. and Cox, G. M. *Experimental Designs.* 2nd ed. Wiley, 1956.
Cox, D. R. *Planning of Experiments.* Wiley, 1958.
Fisher, R. A. *Statistical Methods for Research Workers.* 13th ed. Oliver & Boyd, 1958.
Fisher, R. A. *Design of Experiments.* 7th ed. Oliver & Boyd, 1960.
Pearce, S. C. *Biological Statistics.* McGraw-Hill, 1965.
Snedecor, G. W. *Statistical Methods.* 5th ed. Iowa, 1956.
Steel, R. G. D. and Torrie, J. W. *Principles and Procedures of Statistics.* McGraw-Hill, 1960.

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 and line breeding. Introduction to population genetics.

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.

WOOL TECHNOLOGY GRADUATE SUBJECTS (GRADUATE DIPLOMA)

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.

GENERAL STUDIES SUBJECTS

All students in faculties other than Arts are required to complete a number of general studies subjects. The general pattern and course outlines for students in the Faculty of Applied Science are listed in the Department of General Studies Handbook, which is available to all students free of cost.